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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

Chandra Observations of Radio-Loud Quasars at $z > 4$: X-rays from the Radio Beacons of the Early Universe

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We present the results of *Chandra* observations of six radio-loud quasars (RLQs) and one optically bright radio-quiet quasar (RQQ) at $z \approx 4.1$–4.4. These observations cover a representative sample of RLQs with moderate radio-loudness ($R \approx 40$–400), filling the X-ray observational gap between optically selected RQQs (predominantly $R \lesssim 2$–10) and the five known blazars at $z > 4$ ($R \approx 800$–27000), where $R = f_{5\ \mathrm{GHz}}/f_{4400\ \mathrm{\AA}}$ (rest frame). We study the relationship between X-ray luminosity and radio-loudness for quasars at high redshift and constrain RLQ X-ray continuum emission and absorption. From a joint spectral fit of nine moderate-R RLQs observed by *Chandra*, we find tentative evidence for absorption above the Galactic N_H, with a best-fit neutral intrinsic column density of $N_H = 2.4^{+2.0}_{-1.8} \times 10^{22}$ cm^{-2}, consistent with earlier claims of increased absorption toward high-redshift RLQs. We also search for evidence of an enhanced jet-linked component in the X-ray emission due to the increased energy density of the cosmic microwave background (CMB) at high redshift, but we find neither spatial detections of X-ray jets nor a significant enhancement in the X-ray emission relative to comparable RLQs at low-to-moderate redshifts. Overall, the $z \approx 4$–5 RLQs have basic X-ray properties consistent with comparable RLQs in the local universe, suggesting that the accretion/jet mechanisms of these objects are similar as well.

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preprint available at http://arxiv.org/abs/astro-ph/0404543

2QZJ215454.3-305654: a radio-quiet BL Lac object or lineless QSO?

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High signal-to-noise spectroscopy has established a redshift of $z = 0.494$ for the source 2QZJ215454.3−305654, originally selected from the 2dF/6dF QSO Redshift Surveys as one of 45 candidate BL Lac objects displaying a featureless continuum at optical wavelengths. Radio observations using the Australia Telescope Compact Array at 1.4 GHz place a 3 sigma upper limit on the object's radio flux density of approx 0.14mJy. The radio-to-optical flux ratio of this object is thus more than 7 times lower than the lowest such ratio observed in BL Lac objects. While the optical properties of 2QZJ215454.3−305654 are consistent with a BL Lac identification, the lack of radio and/or X-ray emission is not. It is uncertain whether this object is an AGN dominated by optical continuum emission from an accretion disk, or is similar to a BL Lac object with optical nonthermal emission from a relativistic jet.

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The Properties and the Evolution of the Highly Ionized Gas in MR 2251−178

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We present the first *XMM-Newton* observations of the radio-quiet quasar MR 2251−178 obtained in 2000 and 2002. The EPIC-pn spectra show a power-law continuum with a slope of $\Gamma = 1.6$ at high energies absorbed by at least two warm absorbers (WAs) intrinsic to the source. The underlying continuum in the earlier observation shows a "soft excess" at low X-ray energies which can be modeled as an additional power-law with $\Gamma = 2.9$. The spectra also show a weak narrow iron Kα emission line. The high-resolution grating spectrum obtained in 2002 shows emission lines from N VI, O VII, O VIII, Ne IX, and Ne X, as well as absorption lines from the low-ionization ions of O III, O IV, and O V, and other confirmed and suspected weaker absorption lines. The O III—O V lines are consistent with the properties of the emission line gas observed as extended optical [O III] emission in this source. The signal-to-noise of the 2000 grating data is too low to detect any lines. We suggest a model for the high-resolution spectrum which consist of two or three warm-absorber (WA) components. The two-components model has a high-ionization WA with a column density of $10^{21.5}$–$10^{21.8}$ cm^{-2} and a low-ionization absorber with a column density of $10^{20.3}$ cm^{-2}. In the three-components model we add a lower ionization component that produce the observed iron M-shell absorption lines. We investigate the spectral variations in MR 2251−178 over a period of 8.5 years using data from *ASCA*, *BeppoSAX*, and *XMM-Newton*. All X-ray observations can be fitted with the above two power laws and the two absorbers. The observed luminosity variations seems to correlate with variations in the soft X-ray continuum. The 8.5 year history of the source suggests a changing X-ray absorber due to material that enters and disappears from the line-of-sight on timescales of several months. We also present, for the first time, the entire *FUSE* spectrum of MR 2251−178. We detect emission from N III, C III, and O VI and at least 4 absorption systems in C III, H I, and O VI, one at −580 km s^{-1} and at least 3 others which are blended together and form a wide trough covering the velocity range of 0 to −500 km s^{-1}. The general characteristics of the UV and X-ray absorbers are consistent with an origin in the same gas.

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preprint available at http://arXiv.org/astro-ph/0404565

Profile variability of the Hα and Hβ broad emission lines in NGC 5548

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Between 1996 and 2002, we have carried out a spectral monitoring program for the Seyfert galaxy NGC 5548 with the 6 m and 1 m telescopes of SAO (Russia) and with the 2.1 m telescope of Guillermo Haro Observatory (GHO) at Cananea, México. High quality spectra with S/N$>$ 50 in the continuum near Hα and Hβ were obtained, covering the spectral range $\sim$(4000 – 7500) Å with a (4.5 to 15) Å-resolution. We found that both the flux in the lines and the continuum gradually decreased, reaching minimum values during May-June 2002. In the minimum state, the wings of Hβ and Hα became extremely weak, corresponding to a Sy1.8 type, not to a Sy1, as observed previously when the nucleus was brighter. The line profiles were decomposed into variable and constant components. The variable broad component is well correlated with the continuum variation. It consists of a double peaked structure with radial velocities $\sim \pm$1000 km/s relative to the narrow component. A constant component, whose presence is independent of the continuum flux variations, shows only narrow emission lines.The mean, rms, and the averaged over years, observed and difference line profiles of Hβ and Hα reveal the same double peaked structure. The relative intensity of these peaks changes with time. During 1996, the red peak was the brightest, while in 1998 – 2002, the blue peak became the brighter one. Their radial velocities vary in the $\sim$ (500 – 1200) km/s range. In 2000 – 2002 a distinct third peak appeared in the red wing of Hα and Hβ line profiles. The radial velocity of this feature decreased between 2000 and 2002: from the observed profiles, from $\sim$ +(2500 – 2600) km/s to $\sim$ +2000 km/s and is clearly seen on the difference profiles. The fluxes of the various parts of the line profiles are well correlated with each other and also with the continuum flux. The blue and red parts of the line profiles at the same radial velocities vary in an almost identical manner. Shape changes of the different parts of the broad line are not correlated with continuum variations and, apparently, are not related to reverberation effects. Changes of the integral Balmer decrement are, on average, anticorrelated with the continuum flux variations. This is probably due to an increasing role of collisional excitation as the ionizing flux decreases. The behavior of the Balmer decrement of the various parts of the line profiles was different in 1996 – 2000 as compared with the 2001 behavior. Our results favor the formation of the broad Balmer lines in a turbulent accretion disc with large and moving "optically thick" inhomogeneities, capable of reprocessing the central source continuum.

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preprint available at http://arxiv.org/abs/astro-ph/0405191

High-Resolution Ultraviolet Spectra of the Dwarf Seyfert 1 Galaxy NGC 4395: Evidence for Intrinsic Absorption[1]

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[1]Based on observations made with the NASA/ESA *Hubble Space Telescope*, obtained at the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS 5-26555; these observations are associated with proposal GO-9362. Also based on observations made with the NASA-CNES-CSA *Far Ultraviolet Spectroscopic Explorer*. *FUSE* is operated for NASA by Johns Hopkins University under NASA contract NAS5-32985.

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We present ultraviolet spectra of the dwarf Seyfert 1 nucleus of NGC 4395, obtained with the *Far Ultraviolet Spectroscopic Explorer (FUSE)* and the *Hubble Space Telescope's* Space Telescope Imaging Spectrograph at velocity resolutions of 7 to 15 km s^{-1}. We confirm our earlier claim of C IV absorption in low-resolution UV spectra and detect a number of other absorption lines with lower ionization potentials. In addition to the Galactic lines, we identify two kinematic components of absorption that are likely to be intrinsic to NGC 4395. We consider possible origins of the absorption, including the interstellar medium (ISM) of NGC 4395, the narrow-line region (NLR), outflowing UV absorbers, and X-ray "warm absorbers." Component 1, at a radial velocity of -770 km s^{-1} with respect to the nucleus, is only identified in the C IV λ1548.2 line. It most likely represents an outflowing UV absorber, similar to those seen in a majority of Seyfert 1 galaxies, although additional observations are needed to confirm the reality of this feature. Component 2, at -114 km s^{-1}, most likely arises in the ISM of NGC 4395; its ionic column densities cannot be matched by photoionization models with a power-law continuum. Our models of the highly ionized X-ray absorbers claimed for this active galactic nucleus indicate that they would have undetectable C IV absorption, but large O VI and H I columns should be present. We attribute our lack of detection of the O VI and Lyβ absorption from the X-ray absorbers to a combination of noise and dilution of the nuclear spectrum by hot stars in the large *FUSE* aperture.

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Nitrogen Enriched Quasars in the Sloan Digital Sky Survey First Data Release

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The quasar Q0353-383 has long been known to have extremely strong nitrogen intercombination lines at λ1486 and λ1750 Å, implying an anomalously high nitrogen abundance of ~ 15 times solar. A search for similar nitrogen-rich quasars in the Sloan Digital Sky Survey First Data Release (SDSS DR1) catalog has yielded 20 candidates, including four with nitrogen emission as strong or stronger than that seen in Q0353-383. Our results indicate that only about 1 in 1700 of quasars have nitrogen abundances similar to Q0353-383, while up to 1 in 130 may be in the process of extreme nitrogen enrichment.

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preprint available at http://arxiv.org/abs/astro-ph/0402205

A new sample of large angular size radio galaxies. III. Statistics and evolution of the grown population

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We present in this paper a detailed study of a new sample of large angular size FR I and FR II radio galaxies and compare the properties of the two classes. As expected, a pure morphology based distinction of FR Is and FR IIs corresponds to a break in total radio power. The radio cores in FR Is are also weaker than in FR IIs, although there is not a well defined break power. We find that asymmetry in the structure of the sample members must be the consequence of anisotropies in the medium where the lobes expand, with orientation playing a minor role. Moreover, literature data and our observations at kiloparsec scales suggest that the large differences between the structures of FR I and FR II radio galaxies must arise from the poorly known central kiloparsec region of their host galaxies. We analyze the sub-sample of giant radio galaxies, and do not find evidence that these large objects require higher core powers. Our results are consistent with giant radio galaxies being the older population of normal FR I and FR II objects evolving in low density environments. Comparing results from our sample with predictions from the radio luminosity function we find no evidence of a possible FR II to FR I evolution. Moreover, we conclude that at

$z \sim 0.1$, one out of four FR II radio sources has a linear size above 500 kpc, thus being in an advanced stage of evolution (for example, older than ~ 10 Myr assuming a jet-head velocity of 0.1c). Radio activity seems to be a short-lived process in active galaxies, although in some cases recurrent: five objects in our sample present signs of reactivation in their radio structures.

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A giant molecular cloud falling through the heart of Cygnus A: clues to the triggering of the activity

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We present intermediate resolution near-IR long-slit spectroscopic data for the nearby radio galaxy Cygnus A (3C 405) (obtained with the NIRSPEC spectrograph on the Keck II telescope). The data reveal considerable complexity in the near-IR emission line kinematics, including line splittings of 200-350 km s^{-1} and a mixture of narrow (FWHM $\sim$200 km s^{-1}) and broad (FWHM $\sim$700 km s^{-1}) components to the emission lines. It is notable that the Paα and H_2 emission lines show markedly different kinematics, both on- and off-nucleus. Overall, the data provide evidence for the presence of a giant molecular cloud falling through the heart of the Cygnus A host galaxy, the motion of which is not driven by the AGN itself. We suggest that this cloud may be connected to the triggering of the activity in this highly powerful AGN. We also detect split H_2 components on the nucleus that are likely to originate in the circum-nuclear torus.

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Implications of Quasar Black Hole Masses at High Redshifts

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We investigated a sample of 15 luminous high-redshift quasars ($3.3 \lesssim z \lesssim 5.1$) to measure the mass of their super-massive black holes (SMBH) and compare, for the first time, results based on C IV, Mg II, and Hβ emission lines at high-redshifts. Assuming gravitationally bound orbits as dominant broad-line region gas motion, we determine black hole masses in the range of $M_{bh} \simeq 2 \times 10^8 M_\odot$ up to $M_{bh} \simeq 4 \times 10^{10} M_\odot$. While the black hole mass estimates based on C IV and Hβ agree well, Mg II typically indicates a factor of $\sim 5\times$ lower SMBH masses. A flatter slope of the Hβ radius – luminosity relation, a possibly steeper slope of the Mg II radius – luminosity relation, and a slightly larger radius of the Mg II BLR than for Hβ could relax the discrepancy. In spite of these uncertainties, the C IV, Mg II, and Hβ emission lines consistently indicate super-massive black hole masses of several times $10^9 M_\odot$ at redshifts up to z=5.1. Assuming logarithmic growth by spherical accretion with a mass to energy conversion efficiency of $\epsilon = 0.1$ and an Eddington ratio L_{bol}/L_{edd} calculated for each quasar individually, we estimate black hole growth-times of the order of several ~ 100 Myr which are smaller than the age of the universe at the corresponding redshift. Assuming high-mass seed black holes ($M_{bh}^{seed} = 10^3$ to $10^5 M_\odot$) the SMBHs in the $z \simeq 3.5$ quasars began to grow at redshifts $z \gtrsim 4$, while for the quasars with $z \gtrsim 4.5$ they started at $z \simeq 6$ to 10. These estimated time scales for forming SMBHs at high redshifts, together with previous studies indicating high quasar metallicities, suggest that the main SMBH growth phase occurs roughly contemporaneously with a period of violent and extensive star formation in proto-galactic nuclei.

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An intense soft-excess and evidence for light bending in the luminous narrow-line quasar PHL 1092

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The narrow-line quasar PHL 1092 was observed by *XMM-Newton* at two epochs separated by nearly thirty months. Timing analyses confirm the extreme variability observed during previous X-ray missions. A measurement of the radiative efficiency is in excess of what is expected from a Schwarzschild black hole. In addition to the rapid X-ray variability, the short UV light curves ($<$ 4 hours) obtained with the Optical Monitor may also show fluctuations, albeit at much lower amplitude than the X-rays. In general, the extreme variability is impressive considering that the broad-band (0.4–10 keV rest-frame) luminosity of the source is $\sim 10^{45}$ erg s^{-1}. During at least one of the observations, the X-ray and UV light curves show common trends, although given the short duration of the OM observations, and low significance of the UV light curves it is difficult to comment on the importance of this possible correlation. Interestingly, the high-energy photons ($>$ 2 keV) do not appear highly variable. The X-ray spectrum resembles that of many narrow-line Seyfert 1 type galaxies: an intense soft-excess modelled with a multi-colour disc blackbody, a power-law component, and an absorption line at $\sim$ 1.4 keV. The $\sim$ 1.4 keV feature is curious given that it was not detected in previous observations, and its presence could be related to the strength of the soft-excess. Of further interest is curvature in the spectrum above $\sim$ 2 keV which can be described by a strong reflection component. The strong reflection component, lack of high-energy temporal variability, and extreme radiative efficiency measurements can be understood if we consider gravitational light bending effects close to a maximally rotating black hole.

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VLT/ISAAC Spectra of the Hβ Region in Intermediate Redshift Quasars

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We present high S/N spectra of the Hβ region in 17 intermediate redshift ($0.85 \leq z \leq 2.5$) quasars. The spectra represent first results of our campaign to test the redshift/luminosity robustness of the so-called Eigenvector 1 (E1) parameter space as developed for low redshift AGN in Sulentic et al. (2000). The new quasars span the luminosity range $-26 \geq M_B \geq -29$ while most of our low redshift sample (n=215) involve sources in the range $-19 \geq M_B \geq -26$. The high redshift sources show E1 parameter values and domain occupation that are similar to our low redshift sample supporting earlier findings that E1 parameters are uncorrelated with source luminosity. Elementary accretion theory can account for a systematic increase of the minimum observed Hβ profile width with source luminosity. Narrow line Seyfert 1 sources with $M_B = -28$ show FWHM(Hβ) as much as 2000 km s^{-1} broader than those with $M_B = -22$. A possible change in the higher redshift/luminosity sources involves systematically weaker [OIII]$\lambda\lambda$4959,5007 narrow line emission.

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Second Epoch Global VLBI Observations of Compact Radio Sources in the M82 Starburst Galaxy

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We have presented the results of a second epoch of global Very Long Baseline Interferometry observations, taken on 23 February 2001 at a wavelength of 18 cm, of the central kiloparsec of the nearby starburst galaxy Messier 82. These observations were aimed at studying the structural and flux evolution of some of the compact radio sources in the central region that have been identified as supernova remnants. The objects 41.95+575 and 43.31+592 have been studied, expansion velocities of $2500\pm1200\,\mathrm{km\,s^{-1}}$ and $7350\pm2100\,\mathrm{km\,s^{-1}}$ respectively have been derived. Flux densities of 31.1 ± 0.3 mJy and 17.4 ± 0.3 mJy have been measured for the two objects. These results are consistent with measurements and predictions from previous epochs.

To be published on the accompanying CD of the Proceedings of IAU Colloquium 192: Supernovae

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preprint available at http://arxiv.org/abs/astro-ph/0405114

Meetings

The 331. Wilhelm und Else Heraeus Seminar: - *The evolution of starbursts*

Convention Centre of the German Physical Society
Bad Honnef, Germany
16-20th August 2004
Third Announcement

Scientific Agenda

Our meeting aims at bringing together different viewpoints on the evolution of starbursts, both from the perspective of the neutral and hot ISM and the stellar component. The focus will be on the interaction of the ISM and the stellar component, and starbursts in the local universe - though the high-redshift population will not be forgotten. Modes and triggering of star formation in different environments will be addressed as well as the properties and structure of the ISM and feedback processes.

The meeting is taking shape nicely, as is shown on our webpage

http://www.astro.rub.de/starbursts/index.html

where you find a list of registered participants, the structure of the program, a description of the venue and quite a bit of additional information.

It is still possible to register

You have to do so before the end of June! We have a limited number of places, and only registering (and paying the conference fee) soon assures your participation.

Please tell us also whether you want to stay in the convention centre of the German Physical Society in a single room (∼50 Euros per night), or in a double room (∼35 Euros per night). This accomodation cost includes three meals a day, i.e. full board. Arrangements for an external hotel (at additional cost) can also be made.

The final title and abstract of your talk are due by June 30th.
The conference fee is 200 Euros, payable also before June 30th.

For instructions on how to pay, please see our website.

If you do not come from Europe and would rather pay the conference fee in cash at the time of the meeting, please tell us directly by email.

The fee includes participation in our excursion and conference dinner. as well as the proceedings.

Excursion / Conference Dinner
On Wednesday, after lunch, a bus will take us south along the Rhine to Koblenz, where the most romantic and famous part of the Rhine river valley starts. The entire valley, with its picturesque small towns, numerous castles and steep vineyards, has been declared a UNESCO world cultural heritage site. The best way to see this is a from a boat - and this is what we will do: In Koblenz we will board a riverboat, part of the 'White Fleet' of Rhine river passenger ships (see http://www.k-d.com/ for more on our carrier). The boat will take us in a little more than three hours to the town of St. Goar.

There, our conference dinner will take place in style. The venue will be the castle of Schloss Rheinfels, of course overlooking the Rhine valley, in particular the well-known region of the 'Loreley'. We will start with drinks on the terrace, followed by a festive and romantic dinner. See http://www.schlosshotel-rheinfels.de/ for more about our destination.

In the late evening, our bus will take us back directly to Bad Honnef.

We will be happy to answer any other question you may have. Please address all communication to manthey@astro.rub.de (Eva Manthey) and huette@astro.rub.de (Susanne Huettemeister) to assure quick replies.

We hope you will be able to join us in the Rhine river valley for exciting discussions on the evolution of starbursts in a unique environment.

Susanne Huettemeister for the SOC and LOC

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/
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