Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
No. 75 — June 2003	Editor: Rob Beswick (rb@ast.man.ac.uk)

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

Simultaneous UV and X-ray Spectroscopy of the Seyfert 1 Galaxy NGC 5548. I. Physical Conditions in the UV Absorbers[1]

D.M. Crenshaw[2,3], S.B. Kraemer[4], J.R. Gabel[4], J.S. Kaastra[5], K.C. Steenbrugge[5], A.C. Brinkman[5], J.P. Dunn [2], I.M. George[6,7], D.A. Liedahl[8], F.B.S. Paerels[9], T.J. Turner[6,7], and T. Yaqoob[7,10]

[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 9279.
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We present new UV spectra of the nucleus of the Seyfert 1 galaxy NGC 5548, which we obtained with the Space Telescope Imaging Spectrograph at high spectral resolution, in conjunction with simultaneous *Chandra X-ray Observatory* spectra. Taking advantage of the low UV continuum and broad emission-line fluxes, we have determined that the deepest UV absorption component covers at least a portion of the inner, high-ionization narrow-line region (NLR). We find nonunity covering factors in the cores of several kinematic components, which increase the column density measurements of N V and C IV by factors of 1.2 to 1.9 over the full-covering case; however, the revised columns have only a minor effect on the parameters derived from our photoionization models. For the first time, we have simultaneous N V and C IV columns for component 1 (at -1040 km s^{-1}), and find that this component *cannot* be an X-ray warm absorber, contrary to our previous claim based on nonsimultaneous observations. We find that models of the absorbers based on solar abundances severely overpredict the O VI columns previously obtained with the *Far Ultraviolet Spectrograph*, and present arguments that this is not likely due to variability. However, models

that include either enhanced nitrogen (twice solar) or dust, with strong depletion of carbon in either case, are successful in matching all of the observed ionic columns. These models result in substantially lower ionization parameters and total column densities compared to dust-free solar-abundance models, and produce little O VII or O VIII, indicating that none of the UV absorbers are X-ray warm absorbers.

Accepted by The Astrophysical Journal, astro-ph/0305154

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XMM-Newton Observations of Two BAL QSOs: Q1246-057 and SBS1542+541

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We report on the results of XMM-Newton observations of two Broad Absorption Line Quasars (BAL QSOs), Q1246-057 and SBS 1542+541. Unprecedented sensitivity of XMM allows spectral analysis of these X-ray weak sources. The X-ray spectral data of these sources can be fitted by a power-law with α_X=1.0-1.2 and either a partially covering absorber or an ionized absorber model. Rest frame UV spectroscopy together with polarimetry favors the model with a partially covering absorber with column density a few times $10^{22}\mathrm{cm}^{-2}$ and a covering fraction of about 0.80. After correcting for absorption, the X-ray loudness of these BAL QSOs appears to be similar to other, unabsorbed quasars. The mystery of X-ray weakness of BAL QSOs appears to be all but solved, with strong absorption being the primary reason. With the available X-ray data, however, the issue of whether BAL QSOs represent highly accreting/ younger population of quasars remains unsettled.

Accepted by Astron. J.

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Elemental Abundances in NGC 3516

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We present Reflection Grating Spectrometer data from an *XMM-Newton* observation of the Seyfert 1 galaxy NGC 3516, taken while the continuum source was in an extremely low flux state. This observation offers a rare opportunity for a detailed study of emission from a Seyfert 1 galaxy as these are usually dominated by high nuclear continuum levels and heavy absorption. The spectrum shows numerous narrow emission lines (FWHM $\lesssim$ 1300 km s^{-1}) in the 0.3 – 2 keV range, including the H-like lines of C, N, and O and the He-like lines of N, O and Ne. The emission-line ratios and the narrow width of the radiative recombination continuum of C VI indicate that the gas is photoionized and of fairly low temperature ($kT \lesssim$ 0.01 keV). The availability of emission lines from different elements for two iso-electronic sequences allows us to constrain the element abundances. These data show that the N lines are far stronger than would be expected from gas of solar abundances. Based on our photoionization models we find that nitrogen is overabundant in the central regions of the galaxy, compared to carbon, oxygen and neon by at least a factor of 2.5. We suggest that this is the result of secondary production of nitrogen in intermediate mass stars, and indicative of the history of star formation in NGC 3516.

Accepted by Ap J.

Complex Optical–X-ray Correlations in the Narrow-Line Seyfert 1 Galaxy NGC 4051

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This paper presents the results of a dense and intensive X-ray and optical monitoring of the narrow-line Seyfert 1 galaxy NGC 4051 carried out in 2000. Results of the optical analysis are consistent with previous measurements. The amplitude of optical emission line variability is a factor of two larger than that of the underlying optical continuum, but part or all of the difference can be due to host-galaxy starlight contamination or due to the lines being driven by the unseen UV continuum, which

is more variable than the optical continuum. We measured the lag between optical lines and continuum and found a lower, more accurate broad line region size of 3.0 ± 1.5 light days in this object. The implied black hole mass is $M_{BH} = 5^{+6}_{-3} \times 10^5 M_\odot$; this is the lowest mass found, so far, for an active nucleus. We find significant evidence for an X-ray–optical (XO) correlation with a peak lag $\lesssim 1$ day, although the centroid of the asymmetric correlation function reveals that part of the optical flux varies in advance of the X-ray flux by 2.4 ± 1.0 days. This complex XO correlation is explained as a possible combination of X-ray reprocessing and perturbations propagating from the outer (optically emitting) parts of the accretion disc into its inner (X-ray emitting) region.

Accepted for publication in MNRAS

The Kinematics and Physical Conditions of the Ionized Gas in NGC 4593 from Chandra High-Energy Grating Spectroscopy

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We observed the Seyfert 1 galaxy NGC 4593 with the *Chandra* high energy transmission gratings and present a detailed analysis of the soft X-ray spectrum. We measure strong absorption lines from He-like O, Ne, Mg, Si, H-like N, O, Ne, Mg, Si and highly ionized Fe XIX-XXV. The weighted mean of the offset velocity of the strongest absorption profiles is -140 ± 35 km s^{-1}. However the individual profiles are consistent with the systemic velocity of NGC 4593 and many profiles hint at the presence of either multiple kinematic components or blending. Only the N VII Lyα (λ24.781) , O VIII Lyα (λ18.969) and Mg XII Lyα (λ8.421) lines appear to be marginally resolved. We identify a spectral feature at ~ 0.707 keV with a neutral Fe L edge, which might suggest that there is dust along the line-of-sight to NGC 4593 although, this is not the only interpretation of this feature. A search for neutral O absorption which would reasonably be expected from dust absorption is complicated by contamination of the *Chandra* ACIS CCDs. Neutral Si absorption, which might also be expected from absorption due to dust is present (though not significantly) in the form of a weak neutral Si edge. The neutral Si column ($< 4 \times 10^{17}$ cm^{-2}) corresponding to the Si edge is consistent with the neutral Fe column ($\sim 1.5 \times 10^{17}$ cm^{-2}) from the Fe L edge. We also detect, at marginal signficance, N VII Lyα (λ24.781) and O VII (r) $1s^2 - 1s2p$ (λ21.602) absorption at $z \sim 0$, due to a hot medium in our Local Group. The soft X-ray spectrum of NGC 4593 is adequately described by a simple, single-zone photoionized absorber with an equivalent Hydrogen column density of $5.37^{+1.45}_{-0.79} \times 10^{21}$ cm^{-2} and an ionization parameter of $\log \xi = 2.52^{+0.06}_{-0.04}$ ergs cm s^{-1} although there remain some features which are not identified. Although the photoionized gas almost certainly is comprised of matter in more than one ionization state and may consist of several kinematic components, data with better signal-to-noise ratio and better spectral resolution are required to justify a more complex model. Finally, in emission we detect only weak forbidden lines of [Ne IX] and [O VII] .

Accepted by Ap. J.

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A limit on nuclear activity in Leo A

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ROSAT HRI observations of Leo A are analysed in order to complement a recent X-ray survey of the centres of Local Group galaxies (Zang & Meurs 2001). It is likely that high-energy cores in galaxies are indicative of some level of nuclear activity. The upper limit 0.1-2.4 keV luminosity determined for Leo A ($\log L_X < 35.77$) is consistent with the results that were obtained for other small Local Group systems. Leo A represents the lowest optical luminosity Irregular galaxy in the Local Group that has been studied at X-rays. Also the *ROSAT* All Sky Survey data allow to derive a (less constraining) upper limit flux for this galaxy.

Accepted by Astron. Astrophys.

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PKS 0537-441: extended [O II] emission and a binary QSO?

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We present high-resolution imaging and low-resolution spectroscopy of the BL Lac object PKS 0537-441 (z = 0.893) and its environment carried out with the ESO-NTT and VLT telescopes. The observations were designed to clarify, whether the properties of PKS 0537-441 are affected by gravitational microlensing due to the claimed detection of a galaxy along the line-of-sight to the BL Lac, or whether PKS 0537-441 and its environment act as a lensing system itself, as suggested by the detection companion galaxies with similar morphologies close to PKS 0537-441.
Our observations show that neither case seems to be likely. Within our images we did not find a galaxy along the line-of-sight to the BL Lac as claimed previously. In addition, our spectroscopy shows that none of the four closest companion galaxies (including one new detection by us) is at high redshift. Instead, two of the four nearby companion galaxies to PKS 0537-441 are within 200 km/s of the systemic velocity of the BL Lac (z = 0.892 and 0.895, respectively). The third companion galaxy is at higher redshift (z = 0.947). The fourth companion galaxy shows evidence of Mg II absorption redwards of its systemic velocity and is perhaps a mini low-ionization BAL QSO at z = 0.885. If the latter can be confirmed, PKS 0537-441 is the first BL Lacertae object being a member of a binary Quasar.
While we do not find (micro)lensing effects being important for this source or its environment, our observations revealed a highly interesting feature. We detected extended [O II] emission in the off-nuclear spectrum of PKS 0537-441, which is most likely due to photoionization from the active nucleus, although we can not rule out the possibility that the extended emission is due to jet-cloud interaction with the counterjet of PKS 0537-441.
According to our analysis of the photometric data, PKS 0537-441 seems to be located in a cluster environment as rich as Abell type 0-1. This is supported by the detection of four galaxies in the field with similar redshifts as the BL Lac (Δ z $<$ 0.002). However, we found serendipitously even more galaxies at somewhat higher redshifts (z = 0.9-1). Thus, PKS 0537-441 might be located in front of a galaxy cluster at somewhat higher redshift or even be part of a large-scale structure with an extension towards the BL Lac.

Accepted by A&A

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preprint available at astro-ph/0305401

Analysis of the Interaction Effects in the Southern Galaxy Pair Tol1238-364 and ESO381-G009

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In the context of the connection among galaxy-galaxy interaction, starbursts and nuclear activity, we present and discuss a quantitative morphological analysis based on BVR images and a detailed spectroscopic investigation of two interacting galaxies, the Seyfert 2 Tol1238-364 (IC 3639) and its companion ESO381-G009, forming a triple system with ESO381-G006. Broad-band optical photometry is complemented by Hα imaging, which provides information about the distribution of star forming regions across the galaxies. Long-slit spectroscopic data obtained at different position angles of the slit are employed to determine the physical conditions of circumnuclear and extranuclear regions. A mixture of thermal and non-thermal ionizing radiation is found in the surroundings of the nucleus of Tol1238-364 and the energy budget supports the presence of a circumnuclear starburst. Several regions in both the galaxies show anomalous line ratios: additional ionization by shock-heating and low ionization of some extranuclear H II regions are suggested as possible explanations. An analysis of the emission-line profiles reveals the presence of a broad Hα component in the nuclear region of Tol1238-364. Independent estimates of the star formation rates (SFR) were obtained through flux-calibrated Hα-images and FIR emission in the four IRAS bands. Overall SFR densities have been compared with the SFR densities derived from Hα emission in the individual regions of the galaxies sampled by long-slit spectra. In both the galaxies an enhancement of the star formation activity with respect to isolated galaxies is revealed. The prevalence of starburst or nuclear activity has been examined through FIR color indices. The interaction scenario is discussed on the basis of the observed galaxy properties.

Accepted by Astrophys. J. Supplements

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Continuum Shielding and Flow Dynamics in Active Galactic Nuclei

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We study the ionization, thermal structure, and dynamics of AGN flows which are partially shielded from the central continuum. We utilize detailed non-LTE photoionization and radiative transfer code using exact (non-Sobolev) calculations. We find that shielding has a pronounced effect on the ionization, thermal structure, and the dynamics of such flows. Moderate shielding is especially efficient in accelerating flows to high velocities since it suppresses the ionization level of the gas. The ionization structure of shielded gas tends to be distributed uniformly over a wide range of ionization levels. In such gas, radiation pressure due to trapped line photons can dominate over the thermal gas pressure and have a significant effect on the thermal stability of the flow. Heavily shielded flows are driven mainly by line radiation pressure, and so line locking has a large effect on the flow dynamics. We show that the observed "L_α ghost" is a natural outcome in highly ionized flows that are shielded beyond the Lyman limit. We suggest that high velocity AGN flows occupy only a small fraction of the volume and that their density depends only weakly on the velocity field.

Accepted by the M.N.R.A.S.

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Non-Sobolev modelling of radiation pressure driven flows in Active Galactic Nuclei

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We present a new general scheme for calculating the structure and dynamics of radiation pressure driven, photoionized flows. The new method goes one step beyond the Sobolev approximation. It involves a numerical solution of the radiative transfer in absorption lines including the effects of differential expansion and line interactions such as line locking and blanketing. We also present a new scheme for calculating the radiation pressure due to trapped line photons in finite, differentially expanding flows. We compare our results for the radiation pressure force with those obtained using the Sobolev approximation and show the limitations of the latter. In particular, we demonstrate that the Sobolev method gives a poor approximation near discontinuity surfaces and its neglect of line blanketing can lead to erroneous results in high velocity flows. We combine the newly calculated radiation pressure force with self-consistent photoionization and thermal calculations to study the dynamics and spectral features of broad absorption line flows and highly ionized gas flows in AGN. A comparison with Sobolev-type calculations shows that the latter over estimates the flow's terminal velocity and, conversely, under estimates its opacity. We also show that line locking on broad emission lines can have a significant effect on the dynamics and spectral features of AGN flows.

Accepted by the M.N.R.A.S.

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ASTRONOMICAL POLARIMETRY
CURRENT STATUS AND FUTURE DIRECTIONS

15-19 March 2004
Waikoloa Beach Marriott, Waikoloa, Hawaii

First Announcement

Dear Colleague,

We are pleased to announce the convening of a Workshop on optical - infrared - mm/submm (OIM) Astronomical Polarimetry, in the wonderful surroundings of the north Kona coast in March 2004. The aim of the Workshop is to bring together workers in all areas of OIM astronomical polarimetry to discuss the most recent results in this exciting and crucial field, and to consider the potential for polarimetry in the era of eight- and ten-metre optical and infrared telescopes. The meeting will concentrate on ground-based polarization measurements, and will include a session devoted to new and novel instrumentation. The remaining sessions will be organized according to the astronomical source rather than to wavelength regime or specific technique. Neither Radio polarimetry nor Solar polarimetry are within the conference remit, but each will be the subject of review talks which will set the scene for two of the conference sessions.

If you are interested in attending this meeting, please note that the conference web site, including registration pages, will open for business on 1-Jun-2003. Emails sent to the conference address (given at the bottom of this note) will give a useful indication of the likely interest. Space may be limited, so we would strongly encourage you to do this at this point.

SCIENCE AREAS

Sessions will be divided into two, with approximately 80% of the time guaranteed for current results and 20% for presentations on future directions, facilities etc. Proceedings, including posters, will be published. Details of the division between oral and poster presentations will be given in the June announcement. The following science areas will be covered:

- Techniques and Instrumentation
- Theory and Modelling
- Interstellar Dust and Gas
- Galaxies, Radio Galaxies and AGN
- Star Formation
- Circumstellar Disks and Extrasolar Planets
- Stars, CVs, Magnetic Stars, Stellar Evolution
- High-redshift and Cosmological Polarimetry

DATES AND DEADLINES

Second Announcement and Web site opens: **1-Jun-2003**
Commencement of Registration: **1-Jun-2003**
Third Announcement: **1-Sep-2003**
End of Early Registration: **1-Dec-2003**
Abstract Deadline: **1-Jan-2004**
Late Registration Deadline: **1-Feb-2004**

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