Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
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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

The X-ray view of the quasar MR 2251-178 and its host cluster: variability, absorption, and intracluster gas emission

Stefanie Komossa[1]

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MR 2251-178 was the first quasar initially discovered in X-rays, and the first one found to host a warm absorber. The quasar turned out to be an outstanding object in many respects. It has a high ratio of X-ray/optical luminosity, is surrounded by the largest quasar emission-line nebula known, and is located in the outskirts of a cluster of galaxies. Here, we present results from an analysis of the X-ray spectral, temporal, and spatial properties of this source and its environment based on deep *ROSAT* observations.

Remarkably, we do not detect any excess X-ray *cold* absorption expected to originate from the giant gas nebula surrounding MR2251-178. This excludes the presence of a huge HI envelope around the quasar. The X-ray spectrum of MR2251-178 is best fit by a warm-absorbed powerlaw with an ionization parameter $\log U = 0.5$ and a column density $\log N_{\rm w} = 22.6$ which, however, cannot be the same material as the giant optical emission line nebula. The mean (0.1–2.4)keV X-ray luminosity amounts to 10^{45} erg/s.

A spatial analysis shows that the bulk of the X-ray emission from the quasar is consistent with a point source, as expected in view of the powerlaw-shaped X-ray spectrum and the rapid X-ray variability we detect. In addition, extended emission appears at weak emission levels, including a bridge between the quasar and the cD galaxy of the cluster.

The X-ray emission from the intra-cluster medium is weak or absent. We derive an upper limit on the X-ray luminosity of $L_{\rm x} \leq 1.6\,10^{42}$ erg/s, weaker than other clusters of comparable richness. None of the other member galaxies of the cluster to which MR 2251-178 belongs, are detected in X-rays. However, east of the quasar there is a significant excess of X-ray sources, several of them without optical counterparts on the UK Schmidt plates.

Astronomy & Astrophysics, in press (scheduled for Feb./March issue)

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Preprint and related papers are available at http://www.xray.mpe.mpg.de/~skomossa/

Millimeter observations of radio-loud active galaxies

Ilse van Bemmel[1,2], and Frank Bertoldi[3]

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In order to study the nature of the far-infrared emission observed in radio-loud active galaxies, we have obtained 1.2 mm observations with the IRAM 30 m telescope for a sample of eight radio-loud active galaxies. In all objects we find that the 1.2 mm emission is dominated by non-thermal emission. An extrapolation of the non-thermal radio spectrum indicates that the contribution of synchrotron emission to the far-infrared is less than 10% in quasars, and negligible in the radio galaxies. The quasars in the sample show signs of relativistic beaming at millimeter wavelengths, and the quasar 3C 334 shows evidence for strong variability.

Accepted by Astronomy & Astrophysics

example:

E-mail contact: bemmel@astro.rug.nl
Preprint available at http://www.astro.rug.nl/Preprints/preprints.html and on astro-ph.

X-rays from the environment of supermassive black holes in active galaxies

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X-rays are a powerful probe of the physical conditions in the nuclei of active galaxies. We review the X-ray properties of radio-quiet AGN, LINERs and ULIRGs based on observations carried out with the X-ray satellite *ROSAT*. We then summarize the observations of giant X-ray flares from non-active galaxies, interpreted as stellar tidal disruptions by supermassive black holes.

Invited review, *IX. Marcel Grossmann Meeting on General Relativity, Gravitation and Relativistic Field Theories*, Session: 'Astrophysics of Neutron Stars and Black Holes', (Rome, July 2000);
2-page condensate will be published in *World Scientific*, extended 10-pages version will appear in the online proceedings at http://www.icra.it/MG/mg9/mg9.htm

E-mail contact: skomossa@xray.mpe.mpg.de;
Preprint and related papers are available at http://www.xray.mpe.mpg.de/~skomossa/

Global molecular gas properties of Seyfert galaxies: I. The observational data

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In this paper we present large-scale maps of the $J = 1 \rightarrow 0$ transitions of CO and HCN in a sample of 7 near-by Seyfert galaxies. These are the first large-scale maps of CO in NGCs 2273 and 5033 and of HCN in all of the sample. From the maps we tabulate the integrated intensities at various extents and calculate the corresponding luminosities. The CO luminosities are compared with those of Young et al. (1995). It is our intention to use these results in conjunction with those of a distant Seyfert sample, in Paper II (Curran et al. 2001), in order to analyse the differences in molecular gas luminosities and distributions, not only between the full sample and other galaxy types, but between the near-by and distant samples. Immediately, from the observational data we see that the HCN is distributed beyond the central beam ($\sim$ 1 kpc) in much of the sample. We consider this to be an important result which we will discuss further in Paper II.

Accepted by Astronomy and Astrophysics

example:

E-mail contact: sjc@oso.chalmers.se,
preprint available at http://www.oso.chalmers.se/~curran

STIS Echelle Observations of the Seyfert Galaxy NGC 4151: Physical Conditions in the Ultraviolet Absorbers[1]

S. B. Kraemer[2], D. M. Crenshaw[2], J. B. Hutchings[3], I.M. George[4,5], A.C. Danks[6], T.R. Gull[7], M.E. Kaiser[8], C.H. Nelson[9], & D. Weistrop[9]

[1]Based on observations made with the NASA/ESA Hubble Space Telescope. STScI is operated by the Association of Universities for Research in Astronomy, Inc. under the NASA contract NAS5-26555.

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We have examined the physical conditions in intrinsic UV-absorbing gas in the Seyfert galaxy NGC 4151, using echelle spectra obtained with the Space Telescope Imaging Spectrograph (STIS) on the *Hubble Space Telescope (HST)* on 1999 July 19. We confirm the presence of the kinematic components detected in earlier Goddard High Resolution Spectrograph (GHRS) observations, all of which appear to be outflowing from the nucleus, as well as a new broad absorption feature at a radial velocity of -1680 km s^{-1}. The UV continuum of NGC 4151 was a factor of about 4 lower than in observations taken over the previous two years, and we argue the changes in the column density of the low ionization absorption lines associated with the broad component at -490 km s^{-1} reflect the decrease in the ionizing flux. Most of the strong absorption lines (e.g., N V, C IV, Si IV, etc.) from this component are saturated, but show substantial residual flux in their cores, indicating that the absorber does not fully cover the source of emission. Our interpretation is that the unocculted light is due to scattering by free electrons from an extended region, which reflects continuum, emission lines, and absorption lines. For the first time in such a study, we have been able to constrain the densities for this kinematic component and several others based on the strength of absorption lines from metastable states of C III and Fe II, and/or the ratios of ground and fine structure lines of O I, C II, and Si II. We have generated a set of photoionization models which not only successfully match the ionic column densities for each component during the present low flux state, but also those seen in previous high flux states with the GHRS and STIS, confirming that the absorbers are photoionized and respond to the changes in the continuum flux. Based on the model parameters (ionization parameter and density), we have been able to map the relative radial positions of the absorbers. We find that the absorbing gas decreases in density with distance. Finally, none of the UV absorbers is of sufficiently large column density or high enough ionization state to account for the observed X-ray absorption, while the scatterer is too highly ionized. Hence, the X-ray absorption must arise in a separate component of circumnuclear gas.

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preprint available at astro-ph/0101037

The obscured mid-infrared continuum of NGC 4418: a dust- and ice-enshrouded AGN

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We report the detection of absorption features in the 6–8 μm region superimposed on a featureless mid-infrared continuum in NGC 4418. For several of these features this is the first detection in an external galaxy. We compare the absorption spectrum of NGC 4418 to that of embedded massive protostars and the Galactic centre, and attribute the absorption features to ice grains and to hydrogenated amorphous carbon grains. From the depth of the ice features we infer that the powerful central source responsible for the mid-infrared emission must be deeply enshrouded. Since this emission is warm and originates in a compact region, an AGN must be hiding in the nucleus of NGC 4418.

Published in A&A 365, L353 (2001)

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Mid-Infrared observations of NGC 1068 with the Infrared Space Observatory

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We report on Mid-Infrared (MIR) observations of the Seyfert 2 galaxy NGC 1068, obtained with ISOCAM in low-resolution spectro-imaging mode. The spatial resolution ($\sim$5") allows us to disentangle the circumnuclear starburst regions from the emission of the active galactic nucleus (AGN). The global spatial distribution of the Unidentified Infrared Bands (UIBs) is similar to the cold dust component, traced by the 450 μm emission and the gaseous component obtained from the ^{12}CO(1-0) map. However, a shift between the maximum of the UIB and 450 μm emission is clearly seen in our maps. The UIBs in the MIR (5-16 μm) originate almost exclusively from the starburst regions in the galactic disk with an emission peaking at the extremity of the stellar/gaseous bar at a distance of 1 kpc from the AGN. The spectrum of the nucleus is characterized *over the whole 5-16 μm range* by a strong continuum which can be fitted with a power law of index $\alpha = -1.7$. Moreover, the high [NeIII]/[NeII] ratio ($\geq$ 2.5) in the nuclear region argues for a hard radiation field from the AGN. Observations indicate that the AGN in NGC 1068 contributes less than $\sim$5% to the total integrated UIB emission even though its hot dust continuum contributes as much as 75% to the total MIR flux. On the contrary, the nuclear contribution to the cold dust emission decreases considerably at submillimeter wavelengths and does not represent more than 25% of the total integrated emission at 450 μm.

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example:

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preprint available at http://arXiv.org/abs/astro-ph/0101038

Chandra X-ray Observations of Cygnus A and Pictor A

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Results from Chandra observations of the two nearest, powerful radio galaxies are summarised.

To be published in the Proceedings of the Oxford Conference "Particles and Fields in Radio Galaxies", Eds R. A. Laing and K. M. Blundell, ASP Conference Series (2001).

E-mail contact: wilson@astro.umd.edu. Preprint available at astro-ph/0101422

Accretion and emission processes in AGN

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The UV-X continuum, the X-ray spectral features, and the variability in these bands provide powerful tools for studying the innermost regions of AGNs from which we gain an insight into the accretion process. In this chapter the discussion focusses on luminous AGN, i.e. Seyfert galaxies and quasars. The standard accretion disk model (a stationary geometrically thin disk) is described, and vertically averaged solutions for the radial structure are given. The emission of the standard disk is discussed using different approximations, and it is compared to the observations. This leads to the conclusion that more complex models are required, such as the irradiated disk and the disk-corona models. The advantage of this last model is that it explains the overall UV-X spectral distribution. In the framework of these disk models, the profile, intensity, and variability properties of the X-ray iron line can be explained by reprocessing at the surface of the cold disk very close to the black hole (the "relativistic disk model"). An alternative possibility is discussed, where the UV-X continuum is produced by a quasi-spherical distribution of dense clouds surrounded by (or embedded in) a hot medium. In such a model the iron line profile could be due to Comptonization instead of relativistic effects

Lectures given at GH Advanced Lectures on the Starburst-AGN Connection, INAOE, June 2000, eds. D. Kunth, I. Aretxaga, World Scientific

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Spectropolarimetry of broad Hα lines in radio galaxies: constraints on the geometry of the broad-line and scattering regions

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We present optical spectropolarimetric observations of three radio-loud broad-line active galactic nuclei: 3C332, 3C351 and 4C73.18, together with new observations of 3C390.3, which we observed previously. Intrinsically polarized broad Hα emission was detected in 3C332 and 3C390.3 at levels of $\sim$3 per cent and $\sim$1 per cent, respectively. Significant polarization was not detected in 3C351, while the polarization measured in 4C73.18 ($\sim$1 per cent) is consistent with foreground contamination by the galactic interstellar medium. Although 3C332 and 3C390.3 both exhibit 'double-peaked' broad Hα line profiles, their polarization properties differ significantly. The polarized Hα emission in 3C332 has a similar profile to that seen in total flux and the continuum and line emission is polarized at 70° to the axis of the radio source. In 3C390.3, however, the double peaks seen in total flux are suppressed in polarized flux and the Hα line and continuum are polarized at $\sim 5^\circ$ to the axis of the radio emission. Comparison of these new observations of 3C390.3 with data obtained 2 years previously reveals significant variations in both total and polarized flux.

The implications of these observations for the relationship between the geometry of the broad-line region and that of the scattering medium are discussed. We argue that models in which the Hα emission arises in a relativistically rotating disc cannot easily explain the observed polarization properties of 3C332 and, in particular, 3C390.3. We consider instead a model in which the line emission originates in a bipolar outflow and present calculations showing that the observed polarization properties of 3C390.3 can be broadly explained by scattering from the inner wall of an obscuring torus, while those of 3C332 are consistent with scattering by particles situated above the poles of the torus. We outline a scheme in which either toroidal or polar scattering dominates in a given object, depending on the orientation of its radio jet axis to our line of sight.

Published in MNRAS 319, 685

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Red synchrotron jets in Parkes quasars

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We present model fits to spectral energy distributions in the optical and NIR of $>$ 100 flat-spectrum radio quasars from the Parkes Half-Jansky Flat-spectrum Sample. We find that $\sim$ 40% of the sources have power-law SEDs, while a similar number show evidence for two primary components: a blue power law and optical synchrotron emission. The blue power law is similar to the dominant component observed in the spectra of optically-selected QSOs. There is strong evidence that the synchrotron component has a turnover in the UV-optical rest frame of the spectrum. In the remaining sources it is likely that the synchrotron peaks at longer wavelengths. This mixture of two components is supported by optical polarisation measurements in a subgroup of the sources. The sources with power law SEDs show evidence for an excess number of red power law slopes compared to optically-selected quasars. There are additional spectral components in some of the sources, such as dust and the underlying galaxy, which have not been considered here.

Accepted by Monthly Notices

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preprint available at http://arXiv.org/abs/astro-ph/0101502

High–resolution radio observations of Seyfert galaxies in the extended 12-micron sample – II. The properties of compact radio components

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We discuss the properties of compact nuclear radio components in Seyfert galaxies from the extended 12 μm AGN sample of Rush et al. (1993). Our main results can be summarised as follows.

Type 1 and type 2 Seyferts produce compact radio components which are indistinguishable in strength and aspect, indicating that their central engines are alike as proposed by the unification model. Infrared *IRAS* fluxes are more closely correlated with low–resolution radio fluxes than high–resolution radio fluxes, suggesting that they are dominated by kiloparsec–scale, extra–nuclear emission regions; extra–nuclear emission may be stronger in type 2 Seyferts. Early–type Seyfert galaxies tend to have stronger nuclear radio emission than late–type Seyfert galaxies. V–shaped extended emission–line regions, indicative of 'ionisation cones', are usually found in sources with large, collimated radio outflows. Hidden broad lines are most likely to be found in sources with powerful nuclear radio sources. Type 1 and type 2 Seyferts selected by their *IRAS* 12 μm flux densities have well matched properties.

Accepted by MNRAS

example:

E-mail contact: ap@jb.man.ac.uk,
preprint available at http://www.jb.man.ac.uk/ ahct/pub.html

3C 236: Radio Source, Interrupted?

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We present new HST STIS/MAMA near-UV images and archival WFPC2 V and R band images which reveal the presence of four star forming regions in an arc along the edge of the dust lane in the giant (4 Mpc) radio galaxy 3C 236. Two of the star forming regions are relatively young with ages of order $\sim 10^7$ yr, while the other two are older with ages of order $\sim 10^8 - 10^9$ yr which is comparable to the estimated age of the giant radio source.

Based on dynamical and spectral aging arguments, we suggest that the fuel supply to the AGN was interrupted for $\sim 10^7$ yr and has now been restored, resulting in the formation of the inner 2 kpc scale radio source. This time scale is similar to that

of the age of the youngest of the star forming regions.

We suggest that the transport of gas in the disk is non-steady and that this produces both the multiple episodes of star formation in the disk as well as the multiple epochs of radio source activity. If the inner radio source and the youngest star forming region are related by the same event of gas transport, the gas must be transported from the hundreds of pc scale to the sub-parsec scale on a time scale of $\sim 10^7$ yr, which is similar to the dynamical time scale of the gas on the hundreds of pc scales.

Accepted by Astron. J.

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Meetings

First Announcement of the workshop on:- AGN variability across the Electromagnetic Spectrum

Sydney, Australia

25 - 29 June 2001

Variability has been an excellent probe of the physical conditions within the most energetic, inner regions of active galactic nuclei (AGN). Such variability is seen across the entire observable electromagnetic spectrum on time-scales from minutes to years and implies energetic processes on a magnitude seen nowhere else in the Universe.

The advances in instrumentation, including improved sensitivity and stability, have enabled better temporal sampling and accuracy of flux density measurements. This has resulted in the discovery of extremely short time scale variability over the entire EM spectrum. Such variability, if intrinsic to the source, suggests extremely small physical scales, that cannot be probed through direct imaging.

The interpretation of the short term fluctuations at radio frequencies is still under debate as intrinsic variability leads to unacceptable physical conditions such as excessive brightness temperatures and opacity problems. The evidence thus far suggests extrinsic mechanisms, such as interstellar scintillation, are dominant.

In this meeting we intend to bring together Australian and overseas participants to address current problems in understanding the astrophysics underlying the mechanisms responsible for the observed variability in AGN. We will focus on a multi-wavelength approach, since the massive energy release from AGN can be understood more fully only by observing its properties over the entire wavelength range available. In addition we intend to discuss future multi-wavelength observing strategies to improve coordination between observatories across the Earth, including the satellite observatories in space.

Key themes: - review of observations at all wavelengths
- interaction between theory and observation
- fundamental mechanisms for intrinsic variability
- radio intra-day variability
- multiwavelength monitoring of AGN
- future observations and theory

Invited speakers include:

Mitch Begelman (University of Colorado)
Joss Bland-Hawthorn (AAO)
Denise Gabuzda (JIVE)
Robert Hartman (NASA/GSFC)
Tadashi Kafune (University of Tokyo)
Kenneth Kellermann (NRAO)
Jean-Pierre Macquart (University of Sydney)
Apostolos Mastichiadis (University of Athens)
Elena Pian (University of Bologna)
Barnaby Rickett (University of California)
Marco Salvati (Arcetri Astrophysical Observatory)
Meg Urry (STScI)
Stefan Wagner (Landessternwarte, Heidelberg)
Rachel Webster (University of Melbourne)

IMPORTANT DEADLINES:

Abstracts	2001 Mar 31
Registration	2001 Mar 31
Proceedings	2001 Jul 31

The number of participants will be limited to approximately 80 people. The registration fee is AU$250 (AU$200 for students). The welcome reception, the morning and afternoon tea, lunch and a CD of the workshop proceedings will be provided. The anticipated cost of the workshop dinner is AU$60.

For more information on the meeting please have a look at our web page: http://www.atnf.csiro.au/people/lkedzior/agn_workshop.html or send an e-mail to agnworkshop@atnf.csiro.au

Scientific Organizing Committee:

Geoff Bicknell (ANU)
David Jauncey (ATNF)
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Don Melrose (University of Sydney)
Franco Pacini (Arcetri Astrophysical Observatory)

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Elizabeth Corbett (AAO)
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Stuart Ryder (AAO)

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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.