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From the Editor

Thanks to all of you who have sent me e-mail messages and abstracts for the newsletter, it is good to see that this is a service people are willing to support. Hopefully the distribution list is working properly now and everyone will receive this second issue. The previous issue and submission template are available from the newsletter web page (see the end the newsletter for the address). As an addition to the newsletter I will be including general notices and the first one is below. As with the first issue please pass this around and suggest that people join the mailing list (by e-mailing me). The deadline for the next edition will be the 18th December.

Cheers,
Ant.

Notices

From Ian McHardy (Southampton),

The Rossi X-ray Timing Explorer is currently monitoring the X-ray bright Seyfert galaxies NGC4051, NGC5548, NGC5506 and MCG-6-30-15. Observations will continue until at least the end of November 1997 at 2-weekly intervals. Monitoring in other bands, particularly optical or UV line profile monitoring, is encouraged. Observers should contact Ian McHardy, Southampton (imh@astro.soton.ac.uk)

Abstracts of recently accepted papers

Low-Luminosity Seyfert Nuclei

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We describe a new sample of Seyfert nuclei discovered during the course of an optical spectroscopic survey of nearby galaxies. The majority of the objects, many recognized for the first time, have luminosities much lower than those of classical Seyferts and populate the faint end of the AGN luminosity function. A significant fraction of the nuclei emit broad Hα emission qualitatively similar to the broad lines seen in classical Seyfert 1 nuclei and QSOs

To appear in *IAU Colloq. 159, Emission Lines in Active Galaxies: New Methods and Techniques*, ed. B. M. Peterson, F.-Z. Cheng, & A. S. Wilson (San Francisco: ASP).

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A Comparison of Radio Axis with Host Galaxy Plane Axis in Seyfert Galaxies

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We use the radio axis as an indicator of the orientation of the obscuring torus in Seyfert galaxies, and analyze the difference between the position angles of extended radio structures and host galaxy major axis of Seyfert 1 and Seyfert 2 galaxies. We find that Seyfert 1's are less likely to have extended radio structures along the host galaxy major axis while Seyfert 2's have these structures distributed in most directions. We also find a zone of avoidance in the distribution of position angles; both Seyfert 1's and Seyfert 2's seem to avoid close alignment between the radio axis and the host galaxy plane axis. These results are analyzed from the point of view of a model in which Seyfert 1's have their obscuring torus axis aligned preferentially along the host galaxy disk axis, and Seyfert 2's have their torus axis laying at an intermediate angle between the galaxy disk and its axis.

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The circumnuclear region in the Seyfert 1 galaxy NGC 3227

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This article presents Hα and [OIII] narrow band images and long-slit optical and near infrared spectroscopy at position angles 65.5° and 25° through the circumnuclear region in the Seyfert 1 galaxy NGC 3227. After subtraction of a bulge+disc model, the continuum image at 5900 Å, shows an excess of emission aligned with the companion galaxy NGC 3226. We attribute this emission to a stellar bar induced by the interaction. Along the leading parts of the bar, we find dust lanes and 70% of the HII regions detected in the disk. The Hα and [OIII] images show extended emission in the circumnuclear region with very different morphologies. [OIII] is elongated to the north, and nearly aligned with the bar. This emission is formed by two kinematical components; a broad component blueshifted with respect to a narrower component. The blue component could be photoionized by radiation from the active nucleus, however the red component might be associated to the starburst detected to the west. The Hα image is aligned along P.A.=65° and shows a bright knot at 4 arcsec SW of the nucleus and a shell-like structure; there the line ratios can be fitted by photoionization by a stellar source. To the north- east, the spectrum shows characteristics of a high excitation LINER, and the line ratios are explained as photoionization by a black body with 140000 K, ionization parameter 0.001, and solar chemical composition with an overabundance of N and S. Even though Hα and [OIII] present different morphology, both are extended 500 pc from the nucleus, inside the inner Linblad resonance; this suggests that gravitational torques, associated to the non- axisymmetric potential produced by the bar and by interaction with the companion galaxy, transport the gas to the ILR from where it fuels the circumnuclear region in NGC 3227.

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HII region population in a sample of nearby galaxies with nuclear activity.I: Data and general results.

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This paper studies the distribution of ionized gas in the disk and circumnuclear region of a sample of 55 galaxies with active nuclei, Seyferts of type 1 and 2, and LINERs. CCD narrow band Hα+[NII] and [OIII] images are used to map the distribution of HII regions and the morphology of the circumnuclear extended emission associated with the active nucleus. An analysis of the presence of extended emission and of HII regions is carried out twofold, as a function of the level of nuclear activity and of the Hubble type. In this sample the extended emission is more common in Seyfert type 1 than in type 2; on the contrary, disk star formation is more common in Seyfert type 2. One third of the galaxies have circumnuclear HII regions, but only 8of these are Seyfert 1. The number surface density of star forming sites and the location of the brightest HII region, indicate that in Seyfert 2 the star formation is more important in the inner disk, as defined by the radius which contains half of the total blue luminosity. However, in Seyfert 1 the distribution of star forming sites is more balanced with distance, and the HII regions are farther away from the nucleus than in Seyfert 2. We discuss on the possible connection between the dynamical properties of the galaxy, particularly in the inner parts, and the differences found in Seyfert types 1 and 2.

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HII region population in a sample of nearby galaxies with nuclear activity.II: Luminosity function, size and radial distributions.

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This paper presents the second part of an extensive study of the properties of the HII region population in a sample of spiral galaxies with an active nucleus. Some 2000 HII regions are considered in this study, distributed in 27 out of the 55 galaxies in the original sample observed in narrow band Hα CCD imaging. About 70% of these HII regions are flux calibrated. We present the luminosity function, size distribution, the relationship between the Hα flux and the size, the emission measure, and the radial distribution of the HII regions in each galaxy. We analyze the main properties of the HII regions attending to the Hubble type and to the level of nuclear activity of the host galaxy.

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ASCA and *ROSAT* X-ray Spectra of High-Redshift Radio-Loud Quasars

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Results are presented on the X-ray properties of 9 high-redshift ($1.2 < z < 3.4$) radio-loud quasars (RLQs) observed by *ASCA* (10 observations) and *ROSAT* (11 observations, for a subset of 6 quasars). New *ASCA* observations of S5 0014+81 (z = 3.38) and S5 0836+71 (z = 2.17) and *ROSAT* observations of PKS 2126-158 for which results were never presented elsewhere, are included.

A simple model consisting of a power law plus cold, uniform absorption gives acceptable fits to the spectra of all sources. The *ASCA* spectra of the 6 brightest objects show evidence for absorption in excess of the Galactic value at a $\gg 99\%$ confidence level. Comparison with the *ROSAT* data suggests that absorption has significantly varied ($\Delta N_{\rm H} \sim 8 \times 10^{20}$ cm^{-2}) in the case of S5 0836+71, on a time-scale of ~ 0.8 yr in the quasar frame. For the remaining 5 sources for which *ROSAT* spectra were available, the two instruments gave consistent results and the data were combined yielding unprecedent spectral coverage (typically $\sim$ 0.4-40 keV in the quasar frame) for high-z quasars. This allows to put severe limits on several different descriptions of the continuum (e.g. broken power law, bremsstrahlung, reflection component). No Fe Kα emission line is detected in any of the *ASCA* spectra. An absorption edge consistent with Fe Kα at the quasar redshift is marginally detected in S5 0014+81. Possible origins for the observed low energy absorption are discussed. In particular, contributions from the molecular clouds and dust present in our Galaxy (usually disregarded) are carefully considered. In the light of the new results for S5 0836+71 and S5 0014+81, absorption intrinsic to the quasars is considered and discussed.

The average slope obtained from the 8 *ASCA* spectra in the observed $\sim$ 0.5–10 keV energy band is $< \Gamma_{0.5-10\rm keV} > \simeq 1.61 \pm 0.04$, with a dispersion $\sigma_{0.5-10\rm keV} \simeq 0.10 \pm 0.03$. The average photon index in the observed 2–10 keV band, where the effect of absorption is negligible, is $< \Gamma_{2-10\rm keV} > \simeq 1.53 \pm 0.05$, with a dispersion $\sigma_{2-10\rm keV}$ ¡$\simeq$ 0.12. Furthermore, the implications of the present results on the calculations of the contribution of quasars to the cosmic X- and γ-ray backgrounds (XRB and GRB) are briefly discussed.

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The Disks of Galaxies with Seyfert and Starburst Nuclei: I. Near-Infrared Colors and Color Gradients

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We present near-infrared (NIR) broadband and color images of 26 galaxies which host Seyfert 1, Seyfert 2, or starburst nuclei (SBNs). The study is focussed on properties of the host galaxies rather than their nuclei and, to this end, careful attention is paid to photometric accuracy and to reliable measurements of the low-surface-brightness outer disk. Inspection of the elliptically-averaged radial brightness and color profiles reveals that: (*i*) the NIR mean colors of the inner and outer disks of Seyferts and starbursts are consistent with those of a normal late-type stellar population, and do not differ significantly with activity class; (*ii*) the color gradients in the outer disks are similar both in sign and magnitude to those observed in normal spirals; (*iii*) red "ridges" in the inner parts of the $J-H$ profile are evident in the majority of SBNs, but only in a few type 1 Seyferts and in no type 2s; (*iv*) circumnuclear blue "dips" in the $J-H$ profile are seen only in type 2 Seyferts. We then construct color images and find ridges, rings, and filaments, not evident in the broadband images, in the inner disks of SBNs and in NGC 7469, a Seyfert 1. The application of a simple model to these features yields evidence for both dust extinction and excess 2-μm emission. Color-color diagrams of individual pixels confirm these results, and also show that the stellar mix in most of the Seyfert 2s comprises a conspicuous contribution from an intermediate-age ($3-5\times10^8$ yrs) population. In conclusion, it appears that ongoing star formation in the inner disks of SBNs is signalled by the presence of dust (and gas); the absence of such features in both Seyfert types implies that star formation episodes are either absent or very old. However, while the blue colors of Seyfert 2s suggest that a burst of star formation did, in fact, occur not more than 10^9 yrs ago, the normal colors of Seyfert 1s imply that any starforming episodes must be significantly older.

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Warping modes in the maser disc of NGC 4258

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We examine the characteristics of warping modes in the maser disc at the centre of NGC 4258. We find that the velocity field associated with the modes is approximately vertical and that its amplitude decreases with radius. This characteristic accounts for the observed position and velocity distribution of the high-velocity maser features of NGC 4258. We also find that the position-velocity diagram calculated for a disc with a warping perturbation pattern is consistent with the observed redward offset of the low-velocity maser features, if the maser emission arises from the upper-half part of the disc.

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Anomalous radio-loudness of Cygnus A and other powerful radio galaxies

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The nearby, extremely powerful radio galaxy Cygnus A stands out as having an atypically low far-infrared/radio luminosity ratio. It is demonstrated that in objects displaying such a low ratio the radio-loudness is anomalously high, which fact is connected to these objects inhabiting dense X-ray haloes. The enhanced radio emission is most likely due to strong radiation losses in the dense environment. It must be concluded that radio luminosity is not a good measure of AGN power.

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Broad band energy distribution of ROSAT detected quasars. I: Radio-loud objects.

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We present a sample of 654 radio quasars from the RASS and the ROSAT point source catalogue and study their broad band properties. The size of this list allows a statistically significant investigation of the soft X-ray properties of various subgroups distinguished by their radio properties. It is found that flat spectrum and steep spectrum quasars have slightly different X-ray properties which can be understood in the frame of a two component model for the emission: a beamed flat spectral component which is more dominant in flat radio spectrum objects and a steep more isotropic soft component. Combinations of these two components lead to the observed correlations of the X-ray spectral slope with the radio spectral properties, with the core dominance and radio loudness of the objects, and with redshift.

Various correlations exist between the radio, optical, and X-ray properties of the sources. Flat spectrum quasars are X-ray louder than steep spectrum objects, the X-ray loudness does not evolve with redshift, and the apparent dependence of α_{ox} on the optical luminosity seems to be due to biases inherent to the data. Simple proportionalities between the luminosities in the different wavelength bands appear to be inappropriate descriptions of the actual physical situation as they do not account for the varying contributions of the core and extended emission in the objects, i.e., the relative fraction of the beamed core to the unbeamed extended radio emission. Both components contribute in all energy bands but the physical processes governing these complex relations are not yet understood.

Finally, redshift dependencies and selection effects influence the correlations as well, leading to deviations from a simple linear relation between the measured quantities in many cases

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Long and short term variability of the emission lines in the nuclear spectrum of the Seyfert galaxy NGC 7469

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23 spectrograms of the nucleus of the Seyfert galaxy NGC 7469 in the optical region have been obtained at the prime focus of the 6m telescope during 1977 January 13–15, while the nucleus was at the minimum brightness. Spectral dispersion was ~ 95 Å/mm, spectral resolution ~ 8 Å. Equivalent widths, relative intensities and profiles of the emission lines H_γ, H_β, [OIII]$\lambda\lambda$ 4959, 5007ÅÅ, (H_α+[NII]) and [SII]$\lambda\lambda$ 6717, 6731ÅÅ were considered to reveal their night–to–night variability. There were found the variations of profiles of Balmer lines and of relative intensities (H_α+[NII])/H_β and [OIII](4959+5007)/H_β. We suppose that this variability is produced by flares in gas, with a duration of several days. We have compared the obtained spectral properties of the nucleus with published colours and spectral properties observed by other authors during 1943–1986. Relation and character of variability of the line ratios (H_α + [NII])/H_β and [OIII]/H_β in neighbour nights is the same as for months and years observations. Profiles of the Balmer lines contain variable components keeping their positions during 20 years. They can be understood as reflecting the ingredients in gaseous structure of NGC 7469 nucleus, which change their brightness with the time without changing their velocities.

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MODELING EXTRAGALACTIC BOWSHOCKS. I. The model

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To probe the effects of the nuclear activity on the host galaxy, it is essential to disentangle the relative contribution of shock excitation from that of photoionization. One milestone towards this goal is the ability to model the bowshock structures created by the interaction of radio ejecta with their surrounding medium. We have built a bowshock model based on TDA's one (Taylor, Dyson & Axon) which was itself derived from an earlier work on Herbig-Haro objects. Since TDA's original model supplied astronomers with only [OIII] λ 5007fluxes and profiles for various models of bowshocks, we undertook to include magnetic field and incorporates all of the atomic data tables of the code MAPPINGS Ic for the computation of ionization states, cooling rates and line emissivities of the gas. This new model allows us to map line ratios and profiles of extragalactic bowshocks for all major lines of astrophysical interest. In this first paper, we present our model, analyse the gas behavior along the bowshock and give some examples of model results.

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[OIII] λ 5007 wing variations and changes of FeII optical multiplets in NGC 5548

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The variations of the [OIII] λ 5007 line profile in NGC 5548 are examined from CCD spectra obtained at the Ohio State University and Crimean Astrophysical Observatory in December 1988 – October 1994. We have found the total flux of [OIII] λ 5007 line to be variable, so the spectral calibration based on the assumption of non-variability of [OIII] λ 5007 line is not absolutely correct. The variations are much more pronounced in the far wings of the line profile ($\sim$1100 km s^{-1}). Assuming the central part of the line profile is non-variable, we analyzed the variations of the red and blue wings relative to the profile center. We have found that these variations can be explained in terms of a reaction to the ionizing radiation changes with a transfer function spreading up to several hundred days. Perhaps, the "real" constant flux is localized in the narrow [OIII] line which belongs to the NLR and has a transfer function of about several hundred years, while the broad wings are emitted from the outer BLR. These wings may belong to FeII λ 5018 and/or [OIII] λ 5007. The transfer function of the blue wing is narrower, with a peak shifted to the zero lag by $\sim$200 days relative to the transfer function of the red wing. Both wings, and especially the blue wing, show weak reaction near the zero lag. These facts must exclude both pure radial and round motion, but may suggest a lack of emitting gas near the line of sight and the presence of an outflow component. The FeII λ 5169 line shows similar behaviour to the [OIII] λ 5007 wings. It confirms FeII λ 5018 is the main contributor to the [OIII] wings or that the broad [OIII] is emitted at the same distance from the central engine as the FeII. The assumption about the presence of "short" and "long" lag spectral components, one of which varies similarly to the Hβ line and the other similarly to the [OIII] λ 5007 wings, permits us to separate these components. The decomposition of the spectra shows that all observed FeII multiplets have a high lag value of the order of several hundred days, pointing to the typical size of the region which emits these lines. The decomposition also shows that there is a short lag component in the red wing of [OIII] λ 5007 line. According to the centroid of this line ($\approx$ 5032 A) it may be identified with the SiII λ 5041, 5056 or HeI λ 5016, 5048.

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Evidence for an outflow from the Seyfert galaxy NGC 4051

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New observations using narrow band imaging, long-slit spectroscopy and MERLIN observations of the nuclear region of the Seyfert galaxy NGC 4051 have been made. An edge brightened, triangular region of ionized gas extending 420 pc from the centre of the galaxy has been detected. Long-slit spectra of this ionised gas, taken at 1.5 arcsec from the core, show the [O III] 5007-Å emission line to consist of two velocity components, both blue-shifted from the systemic radial velocity, with velocity widths of 140 km s^{-1} and separated by 120 km s^{-1}. This region is co-spatial with weak extended radio emission and is suggestive of a centrally driven outflow. The [O III] 5007-Å line spectrum and image of this region have been modelled as an outflowing conical structure at 50° to the line of sight with a half opening angle of 23°.

In addition to the extended structure, high resolution MERLIN observations of the 18-cm nuclear radio emission reveal a compact (1 arcsec) radio triple source in PA 73°. This source is coincident with the HST-imaged emission line structure. These high resolution observations are consistent with a more compact origin of activity (i.e. a Seyfert nucleus) than a starburst region.

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http://axp2.ast.man.ac.uk:8000/Preprints.html

Thesis Abstracts

Thermal Dust Reverberation In Active Galactic Nuclei

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An unprecedented monitoring campaign was carried out primarily with the UCLA 24-inch telescope on a monthly timescale for 51 Seyfert 1 galaxies and quasars. Simultaneous optical and infrared photometry was obtained in order to search for characteristic signatures of thermal dust reverberation. A dozen promising cases of correlated variations were detected, and among them, Markarian 744 was well-modeled by reverberation.

This theoretical model, fully described and tested here, generates an infrared light curve based on observed optical variations and the assumption that this variability extends into the unobserved ultraviolet which drives the dust to respond. Through varying free parameters, the output infrared light curve is fit to the observed data points. For Mrk 744, a lag time of 32 days and a dust temperature of 1750 K were derived.

Two other objects, NGC 6814 and IRAS 03450+0055, were also modeled. NGC 6814 showed a lag time consistent with zero, and the model provides a reasonable fit to the observed data. IRAS 03450+0055 showed a correlation between two events in both light curves, but since this object has less significant variations, the thermal dust model is not as compelling.

It is generally accepted that the galaxy Fairall 9 provides a strong case for reverberation, via Barvainis (1992). His methods and results are closely examined here and compared with mine. In contrary to what Barvainis claims, my results indicate that it may be impossible to derive a sensible reverberation model for this object.

An untapped resource of untold value is available to the field of AGN variability: amateur astronomers. A world-wide network of observers is already established in the form of the American Association of Variable Star Observers (AAVSO), an organization whose contributions to variable star research are well known. Many of these backyard observers are even now making professional quality observations with CCD cameras. The extension of the AAVSO into variable galactic nucleus observing would be a logical and straightforward undertaking. The benefits of such collective efforts between professional and amateur astronomers are obvious. To highlight the possibilities, a continuing collaboration with one individual is described.

Ph.D. Dissertation, to be filed in December 1996

E-mail contact: nelson@astro.ucla.edu, one chapter appeared in ApJL 465 L87. See
http://www.journals.uchicago.edu/ApJ/journal/issues/ApJL/v465n2/5213/5213.html

Jobs

Meetings

The Active Galaxies Newsletter is available on the World Wide Web. You can access it via the University of Manchester home page :- http://axp2.ast.man.ac.uk:8000/~ajh/agn/