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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

Iron K Features in the Quasar E 1821+643: Evidence for Gravitationally Redshifted Absorption?

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We report a *Chandra* high-energy grating detection of a narrow, redshifted absorption line superimposed on the red wing of a broad Fe K line in the $z = 0.297$ quasar E1821+643. The absorption line is detected at a confidence level, estimated by two different methods, in the range $\sim 2 - 3\sigma$. Although the detection significance is not high enough to exclude a non-astrophysical origin, accounting for the absorption feature when modeling the X-ray spectrum implies that the Fe-K emission line is broad, and consistent with an origin in a relativistic accretion disk. Ignoring the apparent absorption feature leads to the conclusion that the Fe-K emission line is narrower, and also affects the inferred peak energy of the line (and hence the inferred ionization state of Fe). If the absorption line (at $\sim$ 6.2 keV in the quasar frame) is real, we argue that it could be due to gravitationally redshifted Fe XXV or Fe XXVI resonance absorption within $\sim 10 - 20$ gravitational radii of the putative central black hole. The absorption line is not detected in earlier *ASCA* and *Chandra* low-energy grating observations, but the absorption line is not unequivocally ruled out by these data. The *Chandra* high-energy grating Fe-K emission line is consistent with an origin predominantly in Fe I–XVII or so. In an *ASCA* observation eight years earlier, the Fe-K line peaked at $\sim$ 6.6 keV, closer to the energies of He-like Fe triplet lines. Further, in a *Chandra* low-energy grating observation the Fe-K line profile was double-peaked, one peak corresponding to Fe I–XVII or so, the other peak to Fe XXVI Lyα. Such a wide range in ionization state of Fe is not ruled out by the HEG and *ASCA* data either, and is suggestive of a complex structure for the line-emitter.

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preprint available at http://xxx.lanl.gov/abs/astro-ph/0502128

The extreme flare in III Zw 2: Evolution of a radio jet in a Seyfert galaxy

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A very detailed monitoring of a radio flare in the Seyfert I galaxy III Zw 2 with the VLA and the VLBA is presented. The relative astrometry in the VLBA observations was precise on a level of a few microarcseconds. Spectral and spatial evolution of the source are closely linked and these observations allowed us to study in great detail a textbook example of a synchrotron self-absorbed jet. We observe a phase where the jet gets frustrated, without expansion and no spectral evolution. Then the jet breaks free and starts to expand with apparent superluminal motion. This expansion is accompanied by a strong spectral evolution. The results are a good confirmation of synchrotron theory and equipartition for jets.

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Kinematics of Ionised Gas in the Barred Seyfert Galaxy NGC 4151

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We have determined the structure and kinematics of ionised gas in the weak oval bar of the archetypal Seyfert 1 galaxy, NGC 4151, using the TAURUS Fabry-Perot interferometer to simultaneously map the distribution and kinematics of Hβ emission. We also present broad-band ultraviolet imaging of the host galaxy, obtained with XMM-Newton, that shows the detailed distribution of star formation in the bar and in the optically-faint outer spiral arms. We compare the distribution and kinematics of ionised gas with that previously determined in neutral hydrogen by Mundell & Shone; we suggest that the distribution of bright, patchy UV emission close to the HI shocks is consistent with ionisation by star clusters that have formed in compressed pre-shock gas. These clusters then travel ballistically through the gaseous shock to ionise gas downstream along the leading edge of the bar. In addition, we detect, for the first time, ionised gas within the shock itself which is streaming to smaller radii in the same manner as the neutral gas.

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Clumpy tori around active galactic nuclei

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We discuss the question whether the matter in dusty tori around active galactic nuclei has a smooth or a clumpy structure. Nenkova, Ivezic & Elitzur (2002) have argued that the lack of emission feature in the SEDs of type 1 AGN galaxies combined with a clear absorption feature in type 2 AGN can be explained if the circumnuclear dust is distributed in discrete clumps. Our aim is to verify this. We use multi-dimensional radiative transfer models of smooth and clumpy tori, and compare the SEDs of equivalent smooth and clumpy models. We find that the 10 micron emission feature of the clumpy models, when seen almost face-on, is not appreciably reduced compared to the equivalent smooth models. Some of the clumpy models have a weak or even absent 10 micron feature, but so do some of the smooth models. On the whole the SEDs of clumpy and smooth tori are similar, but some details are different. The absorption feature seen at edge-on inclinations appears to be less deep in the clumpy models than in the smooth models, and the average flux in the near-infrared regime is stronger in the clumpy models. Moreover, at these inclinations the clumpy models have a slightly wider SED. Whether these differences are unique enough to be used as a

diagnostic for clumpiness of AGN tori is not yet clear.

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Dynamical and Spectral Modeling of the Ionized Gas and Nuclear Environment in NGC 3783

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We present a new approach for calculating the physical properties of highly ionized X-ray flows in active galactic nuclei (AGN). Our method relies on a detailed treatment of the structure, dynamics and spectrum of the gas. A quantitative comparison of our model predictions with the 900 ksec Chandra/HETG X-ray spectrum of NGC 3783 shows that: (1) The highly ionized outflow is driven by thermal pressure gradients and radiation pressure force is less important. (2) A full featured dynamical model that provides a very good fit to the high resolution X-ray spectrum requires a multi-phased flow with a density power spectrum reminiscent of the interstellar medium. (3) Adiabatic cooling is an important factor and so is an additional heating source that may be related to the apparent multi-phase and turbulent nature of the flow. (4) The base of the flow is 1pc from the central object, in agreement with some, but not all previous estimates. (5) The mass loss rate is in the range 0.01-0.1 solar masses per year which is smaller than previous estimates and of the same order of the mass accretion rate in this object.

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E-mail contact: doron@ias.edu preprint available at http://arxiv.org/abs/astro-ph/0502272

Restoration of Brightness Distributions across Quasar's Accretion Disk from Observations of High Magnification Events in Components of Gravitational Lens QSO 2237+0305

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We present a technique for the successive restoration of the branches of the one-dimensional strip brightness distribution across a quasar's accretion disk via the analysis of observations of high magnification events in measured fluxes from the multiple quasar images produced by a gravitational lens. Hypothesizing these events to by associated with microlensing by a fold caustic, the branches of brightness distribution are searched for on compact sets of non-negative, monotonically non-increasing, convex downward functions. The results of numerical simulations show that the solution obtained is stable against random noise. Analysis of the light curves of high magnification events in the fluxes from components C and A of the gravitational lens QSO 2237+0305, observed by the OGLE and GLITP groups, has yielded the forms of the strip brightness distributions across the accretion disk of the lensed quasar. The resulting sizes of the accretion disk are in agreement with results obtained earlier via model-fitting. The form of the brightness distribution is consistent with the expected appearance of an accretion disk rotating around supermassive black hole.

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Intrinsic Curvature in the X-ray Spectra of BL Lacertae Objects

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We report results from *XMM-Newton* observations of thirteen X-ray bright BL Lacertae objects, selected from the *Einstein* Slew Survey sample. The survey was designed to look for evidence of departures of the X-ray spectra from a simple power law shape (i.e., curvature and/or line features), and to find objects worthy of deeper study. Our data are generally well fit by power-law models, with three cases having hard ($\Gamma < 2; dN/dE \propto E^{-\Gamma}$) spectra that indicate synchrotron peaks at $E \gtrsim 5$ keV. Previous data had suggested a presence of absorption features in the X-ray spectra of some BL Lacs. In contrast, none of these spectra show convincing examples of line features, either in absorption or emission, suggesting that such features are rare amongst BL Lacs, or, more likely, artifacts caused by instrumental effects. We find significant evidence for intrinsic curvature (steepening by $d\Gamma/d(\log E) = 0.4 \pm 0.15$) in fourteen of the seventeen X-ray spectra. This cannot be explained satisfactorily via excess absorption, since the curvature is essentially constant from $0.5 - 6$ keV, an observation which is inconsistent with the modest amounts of absorption that would be required. We use the *XMM-Newton* Optical Monitor data with concurrent radio monitoring to derive broadband spectral energy distributions and peak frequency estimates. From these we examine models of synchrotron emission and model the spectral curvature we see as the result of episodic particle acceleration.

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The Connection Between the Narrow-Line Region and the UV Absorbers in Seyfert Galaxies[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-8340.
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We present evidence that the outflowing UV absorbers in Seyfert 1 galaxies arise primarily in their inner narrow (emission) line regions (NLRs), based on similarities in their locations, kinematics, and physical conditions. 1) *Hubble Space Telescope* observations show that nearly all Seyfert galaxies have bright, central knots of [O III] emission in their NLRs with radii of tens of parsecs. These sizes are consistent with most previous estimates of the distances of UV (and X-ray) absorbers from their central continuum sources, and a recently-obtained reliable distance of ∼25 pc for a UV absorber in the Seyfert 1 galaxy NGC 3783. 2) The nuclear emission-line knots in a sample of 10 Seyfert galaxies have velocity widths of 300 – 1100 km s^{-1} (half-width at zero intensity), similar to the radial velocities of most UV absorbers. The highest radial velocity for a Seyfert UV absorber to date is only -2100 km s^{-1}, which is much lower than typical broad-line region (BLR) velocities. There is also mounting evidence that the NLR clouds are outflowing from the nucleus, like the UV absorbers. 3) If our hypothesis is correct, then the NLR should have a component with a high global covering factor (C_g) of the continuum source and BLR, to match that found from previous surveys of UV absorbers (C_g = 0.5 – 1.0). Using STIS spectra of NGC 4151, obtained when the continuum and BLR fluxes were low, we find evidence for optically thin gas in its nuclear emission-line knot. We are able to match the line ratios from this gas with photoionization models that include a component with $C_g \approx 1$ and an ionization parameter and hydrogen column density that are typical of UV absorbers.

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A Multi-wavelength Study of the Ultra-Luminous X-ray Sources in NGC 5018

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The E3 giant elliptical galaxy NGC 5018 was observed with the *Chandra* X-ray Observatory's Advanced CCD Imaging Spectrometer for 30 ks on 14 April 2001. Results of analysis of these X-ray data as well as of complementary optical, infrared, and radio data are reported. Seven X-ray point sources, including the nucleus, were detected. If they are intrinsic to NGC 5018, then all six non-nuclear sources have luminosities exceeding 10^{39} ergs s^{-1} in the 0.5–8.0 keV energy band; placing them in the class of Ultra-luminous X-ray sources. Comparison of X-ray source positions to archival Hubble Space Telescope/Wide Field Planetary Camera 2 (*Hubble*/WFPC2) images reveal four of the six non-nuclear sources are spatially–coincident with bright, $M_V \lesssim$-8.6 mag, objects.

These four objects have optical magnitudes and (V–I) colors consistent with globular clusters in NGC 5018 but they also have X-ray-to-optical flux ratios consistent with background active galactic nuclei. Strong, unpolarized, radio emission has been detected from one of the optically-bright counterparts. Another optically-bright counterpart was observed to vary by $\sim$1 mag in optical observations taken 28 July 1997 and 04 Feb 1999. Extended X-ray emission is detected within a $\sim 15''$ radius of the galaxy center at a luminosity of $\sim 10^{40}$ ergs s^{-1} in the X-ray band. Its thermal X-ray spectrum ($kT \sim 0.4$ keV) and its spatial coincidence with strong Hα emission are consistent with a hot gas origin. The nucleus itself may be a weak X-ray source, $L_X \lesssim 3.5 \times 10^{39}$ ergs s^{-1}, that displays a radio spectrum typical of AGN.

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VPMS J1342+2840 – an unusual quasar from the variability and proper motion survey

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We report the discovery of the highly peculiar, radio-loud quasar VPMS J1342+2840 ($z \approx 1.3$) from the variability and proper motion survey. We present spectroscopic, imaging and photometric observations. The unusual spectrum shows a strong depression of the continuum over a wide wavelength range in the blue part without the typical structures of broad absorption line (BAL) troughs. The image of the quasar is unresolved and there is no evidence for a foreground object on the line of sight. The broad-band spectral energy distribution is not consistent with obvious dust reddening with the standard SMC extinction curve. The downturn of the continuum flux of VPMS J1342+2840 at short wavelengths can be caused by dust reddening only if the reddening curve is steeper then the SMC curve in the ultraviolet and is very flat at longer wavelengths. Alternatively, the dominant spectral features can be explained by low-ionization BALs forming unusually wide, overlapping absorption troughs.

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Variability of Fe II Emission Features in the Seyfert 1 Galaxy NGC 5548

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We study the low-contrast Fe II emission blends in the ultraviolet (1250–2200A) and optical (4000–6000A) spectra of the Seyfert 1 galaxy NGC 5548 and show that these features vary in flux and that these variations are correlated with those of the optical continuum. The amplitude of variability of the optical Fe II emission is 50of Hbeta and the ultraviolet Fe II emission varies with an even larger amplitude than Hbeta. However, accurate measurement of the flux in these blends proves to be very difficult even using excellent Fe II templates to fit the spectra. We are able to constrain only weakly the optical Fe II emission-line response timescale to a value less than several weeks; this upper limit exceeds all the reliably measured emission-line lags in this source so it is not particularly meaningful. Nevertheless, the fact that the optical Fe II and continuum flux variations are correlated indicates that line fluorescence in a photoionized plasma, rather than collisional excitation, is responsible for the Fe II emission. The iron emission templates are available upon request.

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An atlas of Calcium triplet spectra of active galaxies

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We present a spectroscopic atlas of active galactic nuclei covering the region around the $\lambda\lambda$8498, 8542, 8662 Calcium triplet (CaT). The sample comprises 78 objects, divided into 43 Seyfert 2s, 26 Seyfert 1s, 3 Starburst and 6 normal galaxies. The spectra pertain to the inner ~ 300 pc in radius, and thus sample the central kinematics and stellar populations of active galaxies. The data are used to measure stellar velocity dispersions ($\sigma_\star$) both with cross-correlation and direct fitting methods. These measurements are found to be in good agreement with each-other and with those in previous studies for objects in common. The CaT equivalent width is also measured. We find average values and sample dispersions of $W_{\rm CaT}$ of 4.6 ± 2.0, $7.0\pm$ and 7.7 ± 1.0 Å for Seyfert 1s, Seyfert 2s and normal galaxies, respectively. We further present an atlas of [SIII]λ9069 emission line profiles for a subset of 40 galaxies. These data are analyzed in a companion paper which addresses the connection between stellar and Narrow Line Region kinematics, the behaviour of the CaT equivalent width as a function of $\sigma_\star$, activity type and stellar population properties.

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The X-ray Emissions from the M87 Jet: Diagnostics and Physical Interpretation

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We reanalyze the deep *Chandra* observations of the M87 jet, first examined by Wilson & Yang (2002). By employing an analysis chain that also includes image deconvolution, knots HST-1 and I are fully separated from adjacent emission. We derive the spatially resolved X-ray spectrum of the jet using the most recent response functions, and find slight but significant variations in the spectral shape, with values of $\alpha_x (S_\nu \propto \nu^{-\alpha})$ ranging from $\sim 1.2-1.4$ (in the nucleus, knots HST-1, D and C) to ~ 1.6 (in knots F, A and B). We make use of VLA radio observations, as well as *HST* imaging and polarimetry data (Perlman et al. 1999, 2001a), to examine the jet's broad-band spectrum and inquire as to the nature of particle acceleration in the jet. As shown in previous papers, a simple continuous injection model for the synchrotron-emitting knots, in which one holds constant both the filling factor, f_{acc}, of the regions within which particles are accelerated and the energy spectrum of the injected particles, cannot account for the flux or spectrum of the X-ray emission. Instead, we propose that f_{acc} is a function of both position and energy and find that in the inner jet, $f_{acc} \propto E_\gamma^{-0.4\pm0.2} \propto E_e^{-0.2\pm0.1}$, and in knots A and B, $f_{acc} \propto E_\gamma^{-0.7\pm0.2} \propto E_e^{-0.35\pm0.1}$, where E_γ is the energy of the emitted photon and E_e is the energy of the emitting electron. In this model, the index, p, of

the relativistic electron energy spectrum at injection ($n(E_e) \propto E_e^{-p}$) is $p = 2.2$ at all energies and all locations along the jet, in excellent agreement with the predictions of models of cosmic ray acceleration by ultrarelativistic shocks (p=2.23). There is a strong correlation between the peaks of X-ray emission and minima of optical percentage polarization, i.e., regions where the jet magnetic field is not ordered. We suggest that the X-ray peaks coincide with shock waves which accelerate the X-ray emitting electrons and cause changes in the direction of the magnetic field; the polarization is thus small because of beam averaging.

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preprint available at http://arxiv.org/abs/astro-ph/0503024

An Atlas of Warm AGN and Starbursts from the IRAS Deep Fields

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We present a set of 180 AGN candidates based on color selection from the IRAS slow-scan deep observations, with color criteria broadened from the initial point-Source Catalog samples so as to include similar objects with redshifts up to $z = 1$ and allowing for two-band detections. Spectroscopic identifications have been obtained for 80 (44%); some additional identifications are secure based on radio detections or optical morphology, although yet unobserved spectroscopically. These spectroscopic identifications include 13 type 1 Seyfert galaxies, 17 type 2 Seyferts, 29 starburst galaxies, 7 LINER systems, and 13 emission-line galaxies so heavily reddened as to remain of ambiguous classification. The optical magnitudes range from $R = 12.0-20.5$; the counts suggest that incompleteness is important fainter than $R = 15.5$. Redshifts extend to $z = 0.51$, with a significant part of the sample at $z > 0.2$. Even with the relaxed color criteria, this sample includes slightly more AGN than star-forming systems among those where the spectra contain enough diagnostic feature to make the distinction. The active nuclei include several broad-line objects with strong Fe II emission, and composite objects with the absorption-line signatures of fading starbursts. These AGN with warm far-IR colors have little overlap with the "red AGN" identified with 2MASS; only a single Sy 1 was detected by 2MASS with $J - K > 2$. Some reliable IRAS detections have either very faint optical counterparts or only absorption-line galaxies, potentially being deeply obscured AGN. The IRAS detections include a newly identified symbiotic star, and several possible examples of the "Vega phenomenon", including dwarfs as cool as type K. Appendices detail these candidate stars, and the optical-identification content of a particularly deep set of high-latitude IRAS scans (probing the limits of optical identification from IRAS data alone).

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First Announcement:-
European Radio Interferometry School

Manchester, UK
5th – 9th September 2005

Dear Collegues,
We are pleased to announce that the University of Manchester/JBO will host the European Radio Interferometry School, next September 2005. The event is sponsored by the EU RadioNet Consortium within the Sixth Framework Programme of the European Commission.

At this stage we invite interested participants to see further information at the conference web page and send a message to eris2005@jb.man.ac.uk in order to be included in the list for future mailing before March 20th, 2005.

AIM OF THE SCHOOL

The purpose of the school is (1) to provide the basics of radio interferometry techniques, (2) to tackle more specialised topics, and (3) to discuss specific problems related to high frequency (millimetre and sub-mm band) and low frequency (metre band) interferometry observing. Important issues in the light of the development of new instruments, such as e-MERLIN, e-VLBI, ALMA and LOFAR will also be covered. For this reason the school is address both to new potential users of radio interferometry, and to people/students already in the field, who wish to broaden their knowledge and skills.

PROGRAMME OF THE SCHOOL

The programme of the school will include science and techniques talks, "practical" talks and hands-on tutorials.

A preliminary list of technical topics includes:

- Basic introduction to radio astronomy and interferometry
- Data calibration and continuum imaging
- Spectral line imaging
- Polarization
- High frequency (mm and sub-mm) data
- Low frequency (metre) data
- Planning an experiment/observation
- Astrometry
- Future instruments and future developments

At the time of registration, participants will be asked to express needs and suggestions, and the programme will be finalised accordingly.

FORMAT OF THE SCHOOL

The school will consist of morning and afternoon sessions, each including one scientific talk, one technical talk and tutorials. Tutorial parallel sessions may be organised, depending on the participants.
Due to space and computing constraints, the school may host at most 70 - 80 participants.
There will be no registration fee and although we expect most attendees to be funded by their institutes, a limited amount of financial support will be available.

SCIENTIFIC ORGANIZING COMMITTEE

R. Beswick (Manchester University, UK)
F. Gueth (IRAM, France)
T. Muxlow (JBO, Jodrell, UK)
R. Porcas (MPIfR, Bonn, Germany)
C. Reynolds (JIVE, Dwingeloo, The Netherlands)
A. Richards (JBO, Jodrell, UK) co-chair
T. Venturi (IRA-CNR, Bologna, Italy) chair

ONE DAY MEETING ON "NEW RESULTS IN X-RAY ASTRONOMY"

Leicester University
Wednesday 6th July 2005

Continuing the series of annual one-day X-ray astronomy meetings in the UK, this year's meeting will be held at the University of Leicester on Wednesay July 6th. The meeting will consist of contributed talks from X-Ray astronomers throughout the UK, on the subject of 'New Results in X-Ray Astronomy'.

This year's meeting should be particularly interesting, with the recently-launched Swift satellite set to provide new and exciting insights into gamma-ray bursts, complementing the wide range of world-class science being undertaken in the UK with the Chandra, XMM-Newton, RXTE and INTEGRAL observatories.

All interested persons are invited to attend. In particular this workshop will provide an opportunity for newer members of the UK high energy community to present results, and to meet with members of other groups working in this area. There will be ample space for posters.

Those interested in attending should forward their contact details to Dr Tim Roberts (tro@star.le.ac.uk) by Friday June 10th. If you wish to participate (oral presentation or poster) please also forward the title and abstract by the closing date (stating oral or poster presentation). A detailed program will be published on the meeting web site shortly after the deadline has passed.

The meeting will be held in the Belvoir Park Lounge on the 2nd floor of the Charles Wilson building at the University of Leicester. Further details and contact information are provided at:

http://www.star.le.ac.uk/ukxra2005

We would be very grateful if you could circulate this announcement to other interested parties at your institute.

Regards,
Prof Bob Warwick, Dr Tim Roberts, Dr Simon Vaughan University of Leicester

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/
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.