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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.
Matt Redman

Abstracts of recently accepted papers

UBVRI observations of the nucleus of NGC 1275 in 1989 – 1994. Microvariability

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Intranight variability of the NGC 1275 nucleus in optics have been studied using five series of photoelectric observations obtained over 37 nights from December 22, 1989 to December 29, 1994. The *UBVRI* monitoring on a single night continued up to 4.5 hours. In total, 820 measurements were performed simultaneously in each of the *UBVRI* bands (3600Å$\leq \lambda_{eff} \leq$8300Å) with the 1.25-m telescope at the Crimean Astrophysical Observatory.

Flux densities (F) with their standard deviations (SD) and the measure of intranight variability – SD/F, were calculated for each night of observations. On 40% of nights an intranight activity of the nucleus was seen at a level of variability SD/F$\geq$ 3% in all spectral bands. An independent activity of the nucleus in the I band (the spectral region $\sim$ 8300Å) is suspected on $\sim$ 10% of nights. The peak amplitude of the variability $F_{max}/F_{min} \sim$ 40% was observed only in one case out of 37 nights.

There was suspected low level intranight variability in each of the *UBVRI* spectral bands for nights with SD/F$\leq$ 3%.

The data which were obtained leads us to argue, that during 1989–1994 a process has operated in the nucleus of the galaxy NGC 1275, which caused variations of the optical flux on a time scale of several hours. We obtain preliminary evidences that the causes of intranight and infranight variations seem to be different. All the data obtained are discussed from the point of view of current models of AGN nuclei.

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Simultaneous *UBVRI* Light Curves of the Seyfert Galaxy NGC 4151 During the Extraordinary Brightening in 1989 – 1996

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We present observations of the nuclear region of the Seyfert galaxy NGC 4151 obtained at Crimean Astrophysical Observatory with the 1.25m telescope. We have performed more than 1500 measurements simultaneously in each spectral band of the $UBVRI$ Johnson's system in the aperture 20″ in diameter during 96 nights on 8 observational runs between 1989, February 11 and 1996, June 14. The estimated accuracy of a single measurement is higher than $0.^m01$.

Light curve of NGC 4151 in each of $UBVRI$ band consists of a slow increase of intensity during almost the entire observing time, and rapid outbursts overlapping on it. The increasing of the nucleus brightness began in 1990, February and continued through 1996, June. The historically unusual extraordinary long–term brightening is going on. Amplitudes of brightening and gradients are decreased from U to I band. Amplitude amounts to $2.^m0$, $1.^m5$, $0.^m9$, $0.^m8$ and $0.^m7$ in the $UBVRI$ bands, respectively. During 7.3 years of our observations gradients (in magnitude per year) of the brightness variations are: 0.30, 0.23, 0.15, 0.13, 0.11 mag/year for $UBVRI$ bands respectively.

Flares with durations of 10–147 days are revealed on smooth $UBVRI$ light curves. Amplitudes of flares $A = F_{max}/F_{min}$ are decreased from U to I band.

Gradients of tens days brightening of the nucleus during the flares in all spectral bands are more than those for all observing time. The largest gradients are observed at the end of the observing period.

$UBVRI$ energy distributions for flux excesses during the flares and during the whole period of observations showed a power law form: $F_\nu \sim \nu^\alpha$. Obtained data were discussed in the frame of the model when increasing of the nucleus brightness is caused by ejection of the clouds emitting synchrotron radiation ejected in jets of the NGC 4151 nucleus during its active period. Calculated spectral slopes for the flares were $+0.18 \geq \alpha_{pl} \geq -1.83$, $\Delta\alpha_{pl} = 2.01$. The increasing of the spectral indexes with time in the adopted model evidences, that an optical depth of synchrotron emission clouds increased from the beginning to the end of the nucleus brightening.

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Centaurus A: multiple outbursts or bursting bubble?

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We present new radio observations of the brighter region of the northern lobe (the Northern Middle Lobe, NML) of Centaurus A obtained at 20 cm with the Australia Telescope Compact Array. The angular resolutions are ∼50 and ∼130 arcsec, therefore much higher than for the previously available radio images of this region. The most interesting feature detected in our images is a *large-scale jet* that connects the inner radio lobe and the NML and that is imaged for the first time. The NML itself appears as diffuse emission with a relatively bright ridge on the eastern side.

The radio morphology of Centaurus A and, in particular, its NML could be the result of a precessing jet that has undergone a strong interaction with the environment at least in the northern side. The very big drop in intensity between the inner jet and the large-scale jet can be explained with a sequence of bursts of activity at different epochs in the life of the source. Alternatively (or additionally) a "bursting bubble" model is proposed to explain this big drop in intensity, which could also explain the good collimation of the large-scale jet. In this model, the plasma accumulated in the inner lobe would be able to "burst" out only through one nozzle that would be the region where the large-scale jet forms. The location of the nozzle would represent a region where the pressure gradient is more favourable.

¿From the comparison between the radio emission and the regions of ionized gas discovered by Graham & Price (the so-called optical filaments) we find that the inner optical filament (∼ 8 kpc from the centre) falls about 2 arcmin (∼ 2 kpc) away from the large-scale radio jet. Thus, the inner filament does not seem to have experienced a *direct* interaction with the radio plasma. The complex velocity field observed in this filament could be therefore due to strong instabilities produced by the "bursting bubble". The outer filaments appear to be, in projection, closer to and aligned with the radio emission in the transition region between the jet and the lobe, arguing for a direct interaction with the radio jet. However, also in this case a more complicated interaction than assumed so far has to be occuring because of the relative position of the ionized and neutral gas regions compared to the radio jet as well as the kinematics of the ionized gas.

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preprint available at http://www.ira.bo.cnr.it/~rmorgant/CentaurusA/ and http://xxx.lanl.gov/abs/astro-ph/9903448

The Molonglo Reference Catalog 1-Jy radio source survey IV: optical spectroscopy of a complete quasar sample

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Optical spectroscopic data are presented here for quasars from the Molonglo Quasar Sample (MQS), which forms part of a complete survey of 1-Jy radio sources from the Molonglo Reference Catalogue. The combination of low-frequency selection and complete identifications means that the MQS is relatively free from the orientation biases which affect most other quasar samples. To date, the sample includes 105 quasars and 6 BL Lac objects, 106 of which have now been confirmed spectroscopically. This paper presents a homogenous set of low-resolution optical spectra for 79 MQS quasars, the majority of which have been obtained at the Anglo-Australian Telescope. Full observational details are given and redshifts, continuum and emission-line data tabulated for all confirmed quasars.

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The nature of the extreme kinematics in the extended gas of high redshift radio galaxies.

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We present UV rest frame spectra of 3 powerful narrow line radio galaxies and the hyperluminous type 2 active galaxy SMM J02399-0136, all at high redshift ($z > 2$). We find high velocities (FWHM > 1000 km s^{-1}) in the *extended* gas of *all* objects. A natural explanation is the interaction between the radio jet and the ambient gas, that drives shocks into the gas and accelerates the clouds. However, the existence of high velocities in regions where such interactions are not taking place implies that other processes can play a role. We discuss here several possible mechanisms.

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Intrinsic Absorption Lines in the Seyfert 1 Galaxy NGC 5548: UV Echelle Spectra from the Space Telescope Imaging Spectrograph

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We present the first observations of a Seyfert galaxy with the echelle gratings on the Space Telescope Imaging Spectrograph (STIS), which provide high-resolution ($\lambda/\Delta\lambda \approx 40{,}000$) coverage of the intrinsic UV absorption lines in NGC 5548. We confirm the presence of five kinematic components of absorption in Lα, C IV, and N V at radial velocities of -160 to -1060 km s^{-1} with respect to the emission lines, and find an additional Lα component near the systemic velocity, which probably arises in the interstellar medium of the host galaxy. Compared to GHRS spectra of the N V and C IV absorption obtained ~2 years earlier, the kinematic components have not changed in radial velocity, but the ionic column densities for two components have decreased. We attribute these variations to changes in the total column of gas, but for one component, we cannot rule out changes in the ionization of the gas.

We have calculated photoionization models to match the UV column densities from each of the five components associated with the nucleus. In four of the components, the ionization parameters (U = 0.15 – 0.80) and effective hydrogen column densities ($N_{eff} = 6.0 \times 10^{18}$ cm^{-2} – 2.8×10^{20} cm^{-2}) cannot produce the O VII and O VIII absorption edges seen in the X-ray warm absorber. The remaining component is more highly ionized (U = 2.4, $N_{eff} = 6.5 \times 10^{21}$ cm^{-2}) and our model matches the previously observed X-ray absorption columns. This component is therefore likely to be responsible for the X-ray warm absorber. It also has the highest outflow velocity and showed the largest variations in column density.

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A comparative HST study of the host galaxies of radio-quiet quasars, radio-loud quasars and radio galaxies: Paper I

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We present the first results from a major HST *WFPC2* imaging study aimed at providing the first statistically meaningful comparison of the morphologies, luminosities, scalelengths and colours of the host galaxies of radio-quiet quasars, radio-loud quasars, and radio galaxies. We describe the design of this study and present the images which have been obtained for the first half of our 33-source sample. We find that the hosts of all three classes of luminous AGN are massive elliptical galaxies, with scalelengths $\simeq$ 10 kpc, and $R-K$ colours consistent with mature stellar populations. Most importantly this is the the first unambiguous evidence that, just like radio-loud quasars, essentially all radio-quiet quasars brighter than $M_R = -24$ reside in massive ellipticals. This result removes the possibility that radio 'loudness' is directly linked to host galaxy morphology, but is however in excellent accord with the black-hole/spheroid mass correlation recently highlighted by Magorrian *et al.* (1998). We apply the relations given by Magorrian *et al.* to infer the expected Eddington luminosity of the putative black hole at the centre of each of the spheroidal host galaxies we have uncovered. Comparison with the actual nuclear R-band luminosities suggests that the black holes in most of these galaxies are radiating at a few percent of the Eddington luminosity; the brightest host galaxies in our low-z sample are capable of hosting quasars with $M_R \simeq -28$, comparable to the most luminous quasars at $z \simeq 3$. Finally we discuss our host-derived black hole masses in the context of the radio-luminosity:black-hole mass correlation recently uncovered for nearby galaxies by Franceschini *et al.* (1998), and consider the resulting implications for the physical origin of radio loudness.

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Ground-based and HST optical-infrared studies of quasar host galaxies at low redshift

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We describe the results from a series of ground-based and HST programs aimed at investigating the host galaxies of both radio-loud and radio-quiet quasars (RLQs & RQQs) and FRII radio galaxies (RGs) at low redshifts ($0.1 < z < 0.3$). Our results are in good agreement with those of other recent studies of host galaxies. In general the hosts of powerful AGN are large, luminous ($> 2L^\star$) galaxies, with underlying stellar populations which are predominantly old and red. The host galaxies of RLQs are massive ellipticals, indistinguishable from the FRII radio galaxies, consistent with unification of these sources by viewing angle. Although we find disc-like hosts around two low-luminosity ($M_R > -23.5$) RQQs, our R-band imaging campaign with HST, though currently incomplete, indicates that *all* quasars with $M_R < -23.5$, occur in massive elliptical galaxies regardless of their radio luminosity.

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Radio Continuum Morphology of Southern Seyfert Galaxies

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We present radio observations for 29 southern Seyfert galaxies selected from a volume limited sample with $cz < 3600$ km s^{-1}, and declination $\delta < 0$ deg. Objects with declination -30 deg $< \delta < 0$ deg were observed with the Very Large Array (VLA) at 6 cm (4.9 GHz) and objects with $\delta < -30$ deg were observed with the Australia Telescope Compact Array (ATCA) at 3.5 cm (8.6 GHz). Both the VLA and the ATCA observations have a resolution of $\sim 1''$. These new observations cover more than 50% of the southern sample with all but two of the 29 objects detected above our limit of 0.15 mJy. Combining these data with data available from the literature gives almost 85% coverage of the southern sample and further expands the radio observations of a distance limited sample by 22%. Collecting additional sources from the literature, consisting of known Seyferts with $cz < 4600$ km s^{-1}, we find that 38% of the sources are unresolved at arcsecond resolution, and 34% have linear radio structure. Our results expand upon and are consistent with earlier studies. We confirm a correlation between the size of the radio structure and the radio luminosity. A comparison between Seyfert types 1 and 2 finds that type 2s tend to have a larger linear size. There is no statistically significant difference in radio power between types 1 and 2, although all the most powerful objects appear to be Seyfert 2's. No significant difference has been found in the spectral indices.

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X-ray Properties of the Weak Seyfert 1 Nucleus in NGC 4639

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Low-luminosity active galactic nuclei (AGNs), of which NGC 4639 is a good example, constitute an important but poorly understood constituent of the nearby galaxy population. We obtained observations of NGC 4639 with *ASCA* in order to investigate its mildly active Seyfert 1 nucleus at hard X-ray energies. Koratkar et al. (1995) have previously shown that the nucleus is a pointlike source in the *ROSAT* soft X-ray band. We detected in the 2–10 keV band a compact central source with a luminosity of 8.3×10^{40} erg s^{-1} (for an adopted distance of 25.1 Mpc). Comparison of the *ASCA* data with archival data taken with the *Einstein* and *ROSAT* satellites shows that the nucleus varies on timescales of months to years. The variability could be intrinsic, or it could be caused by variable absorption. More rapid variability, on a timescale of $\sim10^4$ s, may be present in the *ASCA* data. The spectrum from 0.5 to 10 keV is well described by a model consisting of a lightly absorbed ($N_{\rm H} = 7.3 \times 10^{20}$ cm^{-2}) power law with a photon index of $\Gamma = 1.68\pm0.12$. We find no evidence for significant emission from a thermal plasma; if present, it can account for no more than ~25% of the flux in the 0.5–2.0 keV band. The limited photon statistics of our data do not allow us to place significant limits on the presence of iron K emission.

Despite its low luminosity, the X-ray properties of the nucleus of NGC 4639 appear quite normal compared to those of more luminous AGNs. The strength of its broad Hα line follows the correlation between broad Hα luminosity and hard X-ray luminosity previous known for luminous objects. Images taken with the *Hubble Space Telescope* detected the nucleus in the ultraviolet at a strength relative to the X-ray band which appears to be quite typical of that found in other AGNs. NGC 5033, another low-luminosity Seyfert 1 galaxy whose optical characteristics closely resemble those of NGC 4639, has also been recently studied with *ASCA*, and we highlight some of the similarities between these two objects.

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The central radio source in the NGC 383 group: jet - IGM interaction ?

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The NGC 383 group is a rich group of galaxies that harbours the central radio source 3C 31 = NGC 383. After presenting results from the X-ray analysis of the extended intra-group medium and the central radio galaxy, we discuss the spatial morphology of X-ray emitting gas as compared to the radio plasma and perform a comparison of the pressures of both components.

4 pages. Contribution to the proc. of the Ringberg workshop on 'Diffuse Thermal and Relativistic Plasma in Galaxy Clusters'

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Morphology of the 12 μm Seyfert Galaxies: II. Optical and Near-Infrared Image Atlas

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We present 263 optical and near-infrared (NIR) images for 42 Seyfert 1s and 48 Seyfert 2s, selected from the Extended 12 μm Galaxy Sample. Elliptically-averaged profiles are derived from the images, and isophotal radii and magnitudes are calculated from these. We also report virtual aperture photometry, that judging from comparison with previous work, is accurate to roughly 0.05 mag in the optical, and 0.07 mag in the NIR. Our B-band isophotal magnitude and radii, obtained from ellipse fitting, are in good agreement with those of RC3. When compared with the B band, V, I, J, and K isophotal diameters show that the colors in the outer regions of Seyferts are consistent with the colors of normal spirals. Differences in the integrated isophotal colors and comparison with a simple model show that the active nucleus+ bulge are stronger and redder in the NIR than in the optical. Finally, roughly estimated Seyfert disk surface brightnesses are significantly brighter in B and K than those in normal spirals of similar morphological type.

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Discovery of Radio Outbursts in the Active Nucleus of M81

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The low-luminosity active galactic nucleus of M81 has been monitored at centimeter wavelengths since early 1993 as a by-product of radio programs to study the radio emission from Supernova 1993J. The extensive data sets reveal that the nucleus experienced several radio outbursts during the monitoring period. At 2 and 3.6 cm, the main outburst occurred roughly in the beginning of 1993 September and lasted for approximately three months; at longer wavelengths, the maximum flux density decreases, and the onset of the burst is delayed. These characteristics qualitatively resemble the standard model for adiabatically expanding radio sources, although certain discrepancies between the observations and the theoretical predictions suggest that the model is too simplistic. In addition to the large-amplitude, prolonged variations, we also detected milder changes in the flux density at 3.6 cm and possibly at 6 cm on short ($\lesssim$ 1 day) timescales. We discuss a possible association between the radio activity and an optical flare observed during the period that the nucleus was monitored at radio wavelengths.

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