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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

A Wind Driven Warping Instability in Accretion Disk

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A wind passing over a surface may cause an instability in the surface such as the flapping seen when wind blows across a flag or waves when wind blows across water. We show that when a radially outflowing wind blows across a dense thin rotating disk, an initially flat disk is unstable to warping. When the wind is subsonic, the growth rate is dependent on the lift generated by the wind and the phase lag between the pressure perturbation and the vertical displacement in the disk caused by drag. When the wind is supersonic, the grow rate is primarily dependent on the form drag caused by the surface. While the radiative warping instability proposed by Pringle is promising for generating warps near luminous accreting objects, we expect the wind driven instability introduced here would dominate in objects which generate energetic outflows.

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preprint available at http://xxx.lanl.gov/abs/astro-ph/0105041

The Centaurus A Northern Middle Lobe as a Buoyant Bubble

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We model the northern middle radio lobe of Centaurus A (NGC 5128) as a buoyant bubble of plasma deposited by an intermittently active jet. The extent of the rise of the bubble and its morphology imply that the ratio of its density to that of the surrounding ISM is less than 10^{-2}, consistent with our knowledge of extragalactic jets and minimal entrainment into the precursor radio lobe. Using the morphology of the lobe to date the beginning of its rise through the atmosphere of Centaurus A, we conclude that the bubble has been rising for approximately 140 Myr. This time scale is consistent with that proposed by Quillen et al. (1993) for the settling of post-merger gas into the presently observed large scale disk in NGC 5128, suggesting

a strong connection between the delayed re-establishment of radio emission and the merger of NGC 5128 with a small gas-rich galaxy. This suggests a connection, for radio galaxies in general, between mergers and the *delayed* onset of radio emission. In our model, the elongated X-ray emission region discovered by Feigelson et al. (1981), part of which coincides with the northern middle lobe, is thermal gas that originates from the ISM below the bubble and that has been uplifted and compressed. The "large-scale jet" appearing in the radio images of Morganti et al. (1999) may be the result of the same pressure gradients that cause the uplift of the thermal gas, acting on much lighter plasma, or may represent a jet that did not turn off completely when the northern middle lobe started to buoyantly rise. We propose that the adjacent emission line knots (the "outer filaments") and star-forming regions result from the disturbance, in particular the thermal trunk, caused by the bubble moving through the extended atmosphere of NGC 5128.

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Exploratory Chandra Observations of the Highest-Redshift Quasars: X-rays from the Dawn of the Modern Universe

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We report exploratory *Chandra* observations of 14 high-redshift (z=4.06–5.27), optically selected quasars. Ten of these quasars are detected, increasing the number of $z > 4$ X-ray detected quasars by 71%. Our detections include four of the five highest-redshift X-ray detected quasars to date, among them SDSSp J021043.17−001818.4, the highest-redshift (z = 4.77) radio-loud quasar detected in the X-ray band. The four undetected objects are the Broad Absorption Line quasars SDSSp J112956.10−014212.4 and SDSSp J160501.21−011220.0, the weak emission-line quasar SDSSp J153259.96−003944.1, and the quasar PSS 1435+3057. A comparison of the quasars' spectral energy distributions (by means of the optical-to-X-ray spectral index, $\alpha_{\rm ox}$) with those of lower-redshift samples indicates that the *Chandra* quasars are X-ray fainter by a factor of ≈ 2. X-ray faintness could be associated with the presence of large amounts of gas in the primeval galaxies harboring these high-redshift quasars, as suggested by recent studies conducted on $z > 4$ quasars in other bands. Using the current *Chandra* data, predictions for the next generation of X-ray observatories, *Constellation-X* and *XEUS*, are also provided.

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Mid Infrared Polarisation of Ultraluminous Infrared Galaxies

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The mid infrared polarisation properties of four Ultraluminous Infrared Galaxies (ULIRGs) have been investigated by broad band filter observations with the ISOCAM instrument on board the Infrared Space Observatory (ISO). The wavelength region from 5 to 18 μm was selected where the emission from the putative torus peaks. We report detection of polarisation for all ULIRGs studied. The fractional polarisation ranges from $\sim 3\%$ up to 8%. The highest polarisation is recorded in Mrk 231 which has a clear AGN signature, whereas the lowest is for Arp 220, which is generally thought to be powered predominantly by star formation. We discuss the various mechanisms that could give rise to the polarisation and conclude that the most likely interpretation is that it is due to magnetically aligned elongated dust grains. This is the same mechanism believed to be operating in a number of galactic sources. The position angle of polarisation could give the projected magnetic field direction and therefore constrain models for the formation of the tori.

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The Unified model and the Seyfert 2 infrared dichotomy

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An optical spectropolarimetric study has shown that the detectability of polarised broad Hα in Seyfert 2 galaxies is correlated to the IRAS f_{60}/f_{25} flux ratio where only those Seyfert 2s with "warm" IRAS colours show polarised broad line emission. It was suggested that those Seyfert 2s with "cool" IRAS colours have highly inclined tori which obscure the broad line scattering screen.

I present here hard X-ray observations inconsistent with this picture showing that the derived column densities of warm and cool Seyfert 2 galaxies are statistically the same. I classify the Bright Galaxy Sample to produce a non-Seyfert comparison. The analysis of the properties of these galaxies with the Seyfert 2s suggest that the IRAS f_{60}/f_{25} flux ratio is consistent with implying the relative strength of galactic to Seyfert emission. I show that this new picture can account for the absence of polarised broad Hα in the cool Seyfert 2s.

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The European Large Area ISO Survey V: a *BeppoSAX* hard X-ray survey of the S1 region

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We present *BeppoSAX* observations of the Southern S1 region in the European Large Area *ISO* Survey (ELAIS). These observations cover an area of ~1.7 sq. deg. and reach an on-axis (~0.7 sq. deg) 2-10 keV (HX) sensitivity of $\sim10^{-13}$ erg s^{-1} cm^{-2}. This is the first HX analysis of an *ISOCAM* survey. We detect 9 sources with a signal to noise ratio SNR$_{HX}$ >3, 4 additional sources with a 1.3 to 10 keV (T) SNR$_T$ >3 and 2 additional sources which appear to be associated with QSOs with SNR$_T$ >2.9. The number densities of the SNR$_{HX}$ >3 sources are consistent with the *ASCA* and *BeppoSAX* logN-logS functions. Six *BeppoSAX* sources have reliable *ISOCAM* 15μm counterparts within ~60 arcsec. All these *ISOCAM* sources have optical counterparts of R<20 mags. Five of these sources have been previously optically classified giving 4 QSOs and 1 BALQSO at z=2.2. The remaining unclassified source has X-ray and photometric properties consistent with that of a nearby Seyfert galaxy. One further HX source has a 2.6σ *ISOCAM* counterpart associated with a galaxy at z=0.325. If this *ISOCAM* source is real, the HX/MIR properties suggest either an unusual QSO or a cD cluster galaxy. We have constructed MIR and HX spectral energy distributions to compute the expected HX/MIR ratios for these classes of objects up to z=3.2 and assess the HX/MIR survey depth.

The BALQSO has an observed X-ray softness ratio and HX/MIR flux ratio similar to QSOs but different to those found for low redshift BALQSOs. This difference can be explained in terms of absorption, and suggests that high redshift BALQSOs should be comparatively easy to detect in the HX band, allowing their true fraction in the high redshift QSO population to be determined.

The QSOs cover a wide redshift range (0.4< z <2.6) and have HX/MIR flux ratios consistent with those found for nearby *IRAS* and optically selected PG QSOs. This suggests that MIR selected QSOs of R<20 mags come from the same population

as optically selected QSOs. We confirm this with a comparison of the B/MIR flux ratios of MIR and blue band selected QSOs.

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The Chandra Deep Field North Survey. VI. The Nature of the Optically Faint X-ray Source Population

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We provide constraints on the nature of the optically faint ($I \geq 24$) X-ray source population from a 1 Ms *Chandra* exposure of a $8.4' \times 8.4'$ region within the Hawaii flanking-field area containing the Hubble Deep Field North region. We detect 47 ($2,400^{+400}_{-350}$ deg^{-2}) optically faint sources down to 0.5–2.0 keV and 2.0–8.0 keV fluxes of $\approx 3 \times 10^{-17}$ erg cm^{-2} s^{-1} and $\approx 2 \times 10^{-16}$ erg cm^{-2} s^{-1}, respectively; these sources contribute $\approx 14\%$ and $\approx 21\%$ of the 0.5–2.0 keV and 2.0–8.0 keV X-ray background radiation, respectively. The fraction of optically faint X-ray sources is approximately constant (at $\approx 35\%$) for 0.5–8.0 keV fluxes from 3×10^{-14} ergs cm^{-2} s^{-1} down to the X-ray flux limit. A considerable fraction ($33^{+14}_{-10}\%$) of the optically faint X-ray sources are Very Red Objects ($I - K \geq 4$). Analysis of the optical and X-ray properties suggests a large number of optically faint X-ray sources are likely to host obscured AGN activity at $z = 1$–3. From these results we calculate that a significant fraction ($\approx$ 5–45%) of the optically faint X-ray source population could be obscured QSOs (rest-frame unabsorbed 0.5–8.0 keV luminosity $> 3 \times 10^{44}$ erg s^{-1}) at $z \leq 3$. Given the number of X-ray sources without I-band counterparts, there are unlikely to be more than ≈ 15 sources at $z > 6$. We provide evidence that the true number of $z > 6$ sources is considerably lower.

We investigate the multi-wavelength properties of optically faint X-ray sources. Nine optically faint X-ray sources have μJy radio counterparts; $\approx 53^{+24}_{-17}\%$ of the optically faint μJy radio sources in this region. The most likely origin of the X-ray emission in these X-ray detected, optically faint μJy radio sources is obscured AGN activity. However, two of these sources have been previously detected at sub-millimeter wavelengths and the X-ray emission from these sources could be due to luminous star formation activity. Assuming the spectral energy distribution of NGC 6240, we estimate the 175 μm flux of a typical optically faint X-ray source to be < 10 mJy; however those sources with detectable sub-millimeter counterparts (i.e., $f_{850\mu m} > 3$ mJy) could be substantially brighter. Hence, most optically faint X-ray sources are unlikely to contribute significantly to the far-IR (140–240 μm) background radiation. However, as expected for sources with AGN activity, the two optically faint X-ray sources within the most sensitive area of the *ISOCAM* HDF-N region have faint (≈ 50 μJy) 15 μm counterparts.

We also provide constraints on the average X-ray properties of classes of optically faint sources not individually detected at X-ray energies. Stacking analyses of optically faint μJy radio sources not individually detected with X-ray emission yields a possible detection (at 98.3% confidence) in the 0.5–2.0 keV band; this X-ray emission could be produced by star formation activity at $z = 1$–3. None of the optically faint AGN-candidate sources in the HDF-N itself are detected at X-ray energies either individually or with stacking analyses, showing that these sources have low X-ray luminosities if they are indeed AGN.

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Orientation and Speed of the Parsec-Scale Jet in NGC 4261 (3C 270)

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NGC 4261 (3C 270) is an elliptical galaxy containing a 300-parsec scale nuclear disk of gas and dust imaged by the Hubble Space Telescope (HST), around a central supermassive black hole. Previous VLBI observations of NGC 4261 revealed a gap in emission in the radio counterjet, presumably due to free-free absorption in the inner parsec of the accretion disk. Here we present three 8 GHz VLBA observations of NGC 4261 that allow us to monitor the location and depth of the gap, and check for motions in the jet and counterjet.

The separation between the brightest peak and the gap is stable, with an upper limit to its motion of $0.01c$, supporting the interpretation of the gap as absorption by an accretion disk rather than an intrinsic jet feature. These observations span a time of order that required for orbiting material in the disk to transit the counterjet, so we are able to search for density changes (clumps) in the disk by monitoring the optical depth of the gap. The optical depth of the gap is stable to within 20% over 5 years at $\tau = 1.1 \pm 0.1$, corresponding to an electron density in the disk that is constant to within 10%.

We measure an apparent speed in the jet of $0.52{\pm}0.07c$. An apparent speed could not be measured for the counterjet due to a lack of identifiable features. From the apparent jet speed and the jet to counterjet brightness ratio, we calculate the viewing angle of the jet to be 63 ± 3 deg and its intrinsic speed to be $0.46 \pm 0.02c$. From the inclination and position angles of the parsec-scale radio jet and outer HST disk rotation axis we calculate a difference between the parsec-scale radio jet and outer HST disk rotation axis of 12 ± 2 deg. Because of its well-defined HST disk and bright parsec-scale radio jet and counterjet, NGC 4261 is ideal for studying the combined disk-jet system, and this is the first case known to us where both the inclination and position angles of both the disk and jet have been determined.

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Shocks and dust survival in nearby active galaxies: implications for the alignment effect

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One of the most popular explanations for the so-called alignment effect in high redshift (z >0.7) radio galaxies is the scattering by dust of the hidden quasar light. As shown by De Young (1998) a problem with the dust scattering model is that the short destruction time-scale for dust grains means that they will not survive the passage of the radio jet.

We investigate the survival of dust in the extended ionised gas of *nearby* active galaxies with jet/gas interactions. We discuss the implications on the alignment effect of high redshift ($\geq$0.7) radio galaxies. We conclude that although shocks are likely to destroy dust grains in regions of interaction, dust might survive in enough quantities to scatter light from the active nucleus and produce alignment between scattered light and the radio structures.

We propose an observational test to investigate the existence of dust in shocked regions based on the sensitivity of calcium to depletion onto dust grains.

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preprint available at http://babbage.sissa.it (astro-ph/0108340)

A Radiation-Hydrodynamical Model for Supermassive Black Hole-to-Bulge Mass Relation and Quasar Formation

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As a potential mechanism to build up supermassive black holes (BHs) in a spheroidal system, we consider the radiation drag effect by bulge stars, which extracts angular momentum from interstellar gas and thus allows the gas to accrete onto the galactic center. With incorporating radiation hydrodynamical equation with simple stellar evolution, it is shown that the BH-to-bulge mass ratio, $f_{\rm BH}$, is basically determined by a fundamental constant, that is, the energy conversion efficiency for nuclear fusion of hydrogen to helium, $\varepsilon = 0.007$. More specifically, $f_{\rm BH}$ is predicted to be $0.3\varepsilon - 0.5\varepsilon$. Based on the present model for BH growth, a scenario for quasar formation is addressed in relation to ultraluminous infrared galaxies.

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Meetings

ACTIVE GALACTIC NUCLEI: FROM CENTRAL ENGINE TO HOST GALAXY

will be held in the Paris-Meudon Observatory
July 23 to 27, 2002

Scientific Organizing Committee:

ABRAMOWICZ (Sweden), BEGELMAN (USA), BLANDFORD (USA), COLLIN (France, co-chair), COMBES (France, co-chair), CZERNY (Poland), FABIAN (UK), GERHARD (Switzerland), HASINGER (Germany), MARASCHI (Italy), NETZER (Israel), REES (UK), SCOVILLE (USA), SHLOSMAN (USA, co-chair), SOL (France), TANAKA (Japan)

The following topics will be discussed:

- The central engine: X-ray and UV view, hot and cold gas, physical processes (gas dynamics and radiation)
- The parsec scale: BLRs, BALRs, warm absorber, inflows and outflows
- Radio loud AGN, jets
- Accretion disks and tori, radiation- and MHD-flows from accretion disks
- The central kiloparsec: fueling of AGN, nuclear starburts, link to the host galaxy, dynamics of central kpc
- Formation of central BH and AGN, symbiosis with the host galaxy, cosmological aspects

A preliminary program as well as a registration form can be found at http://www.obspm.fr/savoirs/seminaire/coll02/AGN02.

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/
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