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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

Host Galaxies and Circum-Galactic Environment of "Narrow Line" Seyfert 1 Nuclei

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This paper presents a statistical study of the host galaxies and environment of a sample of 27 "Narrow Line" Seyfert 1 Nuclei (NLSy1), based on a computer-aided search of companions on the Digitized Sky Survey. The sample includes all objects listed as NLSy1 in the Veŕon-Cetty & Véron Catalog (VIII$^{\rm th}$ Edition), with redshift in the range $0.010 \leq z \leq 0.061$, and galactic latitude $|b_{\rm II}| \geq 30°$. We compared the environment of NLSy1 with those of Seyfert 1 and Seyfert 2 galaxies using the method and the Seyfert samples employed by Dultzin-Hacyan et al. 1999. The frequency of "physical" companions was measured within a search radius equal to three times the diameter D_S of each NLSy1 galaxy, and up to a projected linear distance of ≈ 100 Kpc. No statistical difference was found between the environments of NLSy1 and Seyfert 1 galaxies. Our results further suggest that NLSy1 hosts may show fewer companions and may be preferentially farther away from bright companion galaxies than normal galaxies with similar morphological type, diameter, and redshift distribution. The results on host galaxies and environments help to disprove the hypothesis that NLSy1 objects have similar characteristics to Seyfert 2 galaxies: while Seyfert 2 galaxies show a highly significant excess of bright companions, Seyfert 1s and NLSy1s do not. The morphological distribution of NLSy1 and Seyfert 1 objects is similar, but NLSy1s are hosted in smaller galaxies than Seyfert 1 and non-active galaxies to a statistical confidence level of 95%. These results support the interpretation of NLSy1s (suggested by X-ray observations) as Seyfert 1 nuclei with higher Eddington ratio, since smaller-diameter galaxies may host central black holes of lower mass.

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Chandra Grating Spectroscopy of the Seyfert Galaxy Ton S180

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We present preliminary results from spectral observations of Ton S180 using *Chandra* and *ASCA*. The data confirm the presence of the soft excess but the *Chandra* LETG spectrum reveals it to be broad and smooth, rather than resolved into individual emission lines. This excess may represent either a primary or reprocessed continuum component or a blend of broad lines from an ionized accretion disk. The occurrence of a similar feature in five other NLSy1s leads us to conclude that this soft X-ray component may be a characteristic of sources accreting at a high rate.

The X-ray spectrum shows no evidence for absorption lines, indicating that if gas exists in the line-of-sight then it is in a very high ionization-state or has an extremely broad velocity distribution. The new *ASCA* data confirm that the narrow component of the Fe Kα line peaks close to a rest-energy of 7 keV, indicating the presence of a significant amount of highly-ionized material in the nuclear environs.

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The Biconical Outflow in the Seyfert Galaxy NGC 2992

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We report on a detailed kinematic study of the galactic-scale outflow in the Seyfert galaxy NGC 2992. The TAURUS-2 Imaging Fabry-Perot Interferometer was used on the Anglo-Australian 3.9-m telescope to derive the two-dimensional velocity field of the Hα-emitting gas over the central arcminute of NGC 2992. The complete two-dimensional coverage of the data combined with simple kinematic models of rotating axisymmetric disks allows us to differentiate the outflowing material from the line-emitting material associated with the galactic disk. The kinematics of the disk component out to R = 3.0 kpc are well modeled by pure circular rotation in a plane inclined at $i = 68^\circ \pm 3^\circ$ from the plane of the sky and with kinematic major axis along P.A. = $32^\circ \pm 3^\circ$. The outflow component is distributed into two wide cones with opening angle $\approx 125 - 135^\circ$ and extending ~ 2.8 kpc ($18''$) on both sides of the nucleus at nearly right angles ($\phi \approx 116^\circ \pm 5^\circ$) to the disk kinematic major axis. The outflow on the SE side of the nucleus is made of two distinct kinematic components interpreted as the front and back walls of a cone. The azimuthal velocity gradient in the back-wall component reflects residual rotational motion which indicates either that the outflowing material was lifted from the disk or that the underlying galactic disk is contributing slightly to this component. A single outflow component is detected in the NW cone. A biconical outflow model with velocities ranging from 50 to 200 km s^{-1} and oriented nearly perpendicular to the galactic disk can explain the data. The broad line profiles and asymmetries in the velocity fields suggest that some of the entrained line-emitting material may lie inside the biconical structure rather than only on the surface of the bicone. The mass involved in this outflow is of order $\sim 1 \times 10^7$ n$_{e,2}^{-1}$ M$_\odot$, and the bulk and "turbulent" kinematic energies are $\sim 6 \times 10^{53}$ n$_{e,2}^{-1}$ ergs and $\sim 3 \times 10^{54}$ n$_{e,2}^{-1}$ ergs, respectively. The most likely energy source is a hot bipolar thermal wind powered on sub-kpc scale by the AGN and diverted along the galaxy minor axis by the pressure gradient of the ISM in the host galaxy. The data are not consistent with a starburst-driven wind or a collimated outflow powered by radio jets.

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The Chandra Multi-wavelength Project (ChaMP): a serendipitous survey with Chandra archival data.

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The launch of the Chandra X-ray Observatory in July 1999 opened a new era in X-ray astronomy. Its unprecedented, < 0.5" spatial resolution and low background are providing views of the X-ray sky 10-100 times fainter than previously possible. We have initiated a serendipitous survey (ChaMP) using Chandra archival data to flux limits covering the range between those reached by current satellites and those of the small area Chandra deep surveys. We estimate the survey will cover ~ 5 sq.deg. per year to X-ray fluxes (2$-$10 keV) in the range $10^{-13} - 6 \times 10^{-16}$ erg cm^{-2} s^{-1} discovering $\sim$2000 new X-ray sources, $\sim 80\%$ of which are expected to be active galactic nuclei (AGN). The ChaMP has two parts, the extragalactic survey (ChaMP) and the galactic plane survey (ChaMPlane). Over five years of Chandra operations, the ChaMP will provide both a major resource for Chandra observers and a key research tool for the study of the cosmic X-ray background (CXRB) and the individual source populations which comprise it. ChaMP promises profoundly new science return on a number of key questions at the current frontier of many areas of astronomy including (1) locating and studying high redshift clusters and so constraining cosmological parameters, (2) defining the true population of AGN, including those that are absorbed, and so constraining the accretion history of the universe, (3) filling in the gap in the luminosity/redshift plane between Chandra deep and previous surveys in studying the CXRB, (4) studying coronal emission from late-type stars as their cores become fully convective and (5) search for cataclysmic variables (CVs) and quiescent Low-Mass X-ray Binaries (qLXMBs) to measure their luminosity functions.

In this paper we summarize the status, predictions and initial results from the X-ray analysis and optical imaging.

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Modeling the X-ray – Optical Correlations in NGC 3516

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We test the "reprocessing paradigm" of optical – UV AGN variability, according to which the variations in this wavelength range are driven by a variable X-ray component, by detailed modeling of the correlated X-ray – optical ($\lambda\lambda$ 3590 and 5510 Å) variability of the recent multiwavelength campaign of NGC 3516. To this end we produce model optical light curves by convolving the *observed* X-ray flux with the response function of an infinite, thin accretion disk, illuminated by a point-like X-ray source located at a given height h_X above the compact object (the lamp-post model). We also produce the ionized X-ray reflection and Fe line spectra that result from the reprocessing of the same X-rays on the disk surface. Then we compare the properties of the model light curves (amplitude, morphology, lags) as well as those of the Fe line profiles to those observed. Our calculations improve on those of similar past treatments by including the effects of an X-ray heated ionized layer in hydrostatic equilibrium on its surface which greately affects its X-ray timing and spectral properties. The results of our calculations do not provide a clear-cut picture which would either support or refute the reprocessing paradigm: Despite the large ($\simeq 50\%$) amplitude excursions of the X-ray flux, the model optical light curves exhibit variability amplitudes of only 3 – 4 % and vary in synchrony in the two optical bands, in agreement with observation. However, the model light curves, when viewed in detail, do not have a direct correspondence to those observed. Futhermore, while the observed X-ray - optical synchrony generally points toward smaller values for the black hole mass ($M = 10^7$ M$_\odot$), the X-ray Fe line, X-ray reflection and optical-UV spectra seem to favor larger mass values ($M = 10^8$ M$_\odot$). Generally, no combination of the model parameters seem to produce agreement with the ensemble of the contraints imposed by optical/UV/X-ray spectral and timing observations; we are thus led to believe

that the simplest version of the lamp-post model geometry is inconsistent with the NGC 3516 observations.

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Molecular gas conditions in NGC 4945 and the Circinus galaxy

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We present results of a multi-transition study of the dense molecular gas in the central part of the hybrid star-burst/Seyfert galaxies NGC 4945 and the Circinus galaxy. From the results of radiative transfer calculations, we estimate in NGC 4945 $n_{\mathrm{H}_2} = 3 \times 10^3 - 10^4$ cm^{-3} and $T_{\mathrm{kin}} \approx 100$ K and in Circinus $n_{\mathrm{H}_2} = 2 \times 10^3 - 10^5$ cm^{-3} and $T_{\mathrm{kin}} \approx 50 - 80$ K for the molecular hydrogen density and kinetic temperature, respectively. As well as density/temperature tracing molecules, we have observed $\mathrm{C^{17}O}$ and $\mathrm{C^{18}O}$ in each galaxy and the value of $\mathrm{C^{18}O/C^{17}O} \approx 6$ for the isotopic column density ratio suggests that both have relatively high populations of massive stars. Finally, although star formation is present, the radiative transfer results combined with the high HCN/CO and (possibly) HCN/FIR, radio/FIR ratios may suggest that, in comparison with Circinus, a higher proportion of the dense gas emission in NGC 4945 may be located in the hypothesised central nuclear disk as opposed to dense star forming cloud cores. Contrary to the literature, which assumes that all of the far-infrared emission arises from star formation, our results suggest that in NGC 4945 some of this emission could arise from an additional source, and so we believe that a revision of the star formation rate estimates may be required for these two galaxies.

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We report on a detailed kinematic study of the galactic-scale outflow in the Seyfert galaxy NGC 2992. The TAURUS-2 Imaging Fabry-Perot Interferometer was used on the Anglo-Australian 3.9-m telescope to derive the two-dimensional velocity field of the Hα-emitting gas over the central arcminute of NGC 2992. The complete two-dimensional coverage of the data combined with simple kinematic models of rotating axisymmetric disks allows us to differentiate the outflowing material from the line-emitting material associated with the galactic disk. The kinematics of the disk component out to R = 3.0 kpc are well modeled by pure circular rotation in a plane inclined at $i = 68° \pm 3°$ from the plane of the sky and with kinematic major axis along P.A. = $32° \pm 3°$. The outflow component is distributed into two wide cones with opening angle $\approx 125 - 135°$ and extending ~ 2.8 kpc ($18''$) on both sides of the nucleus at nearly right angles ($\phi \approx 116° \pm 5°$) to the disk kinematic major axis. The outflow on the SE side of the nucleus is made of two distinct kinematic components interpreted as the front and back walls of a cone. The azimuthal velocity gradient in the back-wall component reflects residual rotational motion which indicates either that the outflowing material was lifted from the disk or that the underlying galactic disk is contributing slightly to this component. A single outflow component is detected in the NW cone. A biconical outflow model with velocities ranging from 50 to 200 km s^{-1} and oriented nearly perpendicular to the galactic disk can explain the data. The broad line profiles and asymmetries in the velocity fields suggest that some of the entrained line-emitting material may lie inside the biconical structure rather than only on the surface of the bicone. The mass involved in this outflow is of order $\sim 1 \times 10^7$ $\mathrm{n}_{e,2}^{-1}$ $M_\odot$, and the bulk and "turbulent" kinematic energies are $\sim 6 \times 10^{53}$ $\mathrm{n}_{e,2}^{-1}$ ergs and $\sim 3 \times 10^{54}$ $\mathrm{n}_{e,2}^{-1}$ ergs, respectively. The most likely energy source is a hot bipolar thermal wind powered on sub-kpc scale by the AGN and diverted along the galaxy minor axis by the pressure gradient of the ISM in the host galaxy. The data are not consistent with a starburst-driven wind or a collimated outflow powered by radio jets.

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