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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.
Matt Redman

Abstracts of recently accepted papers

Hubble Space Telescope Imaging of the Circinus Galaxy

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We present an HST imaging study of the nearby (4 Mpc distant) Circinus galaxy, which contains the nearest type 2 Seyfert nucleus and prominent circumnuclear star formation. Images have been obtained in the [OIII]λ5007, Hα and H_2 v=1–0 S(1) emission lines, and in the green (5470 Å), red (8140 Å) and near infrared (2.04 and 2.15 μm) continua. An image in the [Fe II] λ1.644 μm line has been taken with a ground-based telescope. The [OIII] and Hα images reveal the detailed structure of the complex of streamers and knots of high-excitation gas, which extends out of the galaxy disk. The morphology some 250 pc from the nucleus strongly suggests that the high-excitation gas is concentrated on the surface of a hollow cone with apex close to the nucleus. Such a structure may result through entrainment of dense gas from a circumnuclear torus in the galaxy disk by a low density, outflowing wind or jet. Within 40 pc of the nucleus, the high-excitation gas takes the form of a striking, filled V-shaped structure extending in the same direction as the larger scale high-excitation emission. This 'V' can be described as an ionization cone, though a matter-bounded structure is also possible. The implied collimation of the ionizing photons or gaseous outflow must occur within 2 pc of the apex of the cone, presumed to be the location of the nucleus.

The Hα image shows a complex structure of HII regions, including the well known starburst ring of radius 150 - 270 pc. In addition, there is a more compact (40 pc radius), elliptical ring of HII regions around the 'ionization cone'. We argue that this latter ring, which we call the nuclear ring, is intrinsically circular and located in the plane of the galaxy disk. Much of the [Fe II] emission is associated with this nuclear, star-forming ring and is presumably powered by supernova remnants. Hot molecular hydrogen extends to within 10 pc of the nucleus, and possibly closer. The intrinsic infrared - optical continuum colors in the inner regions of the Circinus galaxy are, in many locations, bluer than is typical of bulges, indicating a relatively young stellar population is present. We confirm the presence of a compact ($<$ 2 pc), very red nuclear source in the K band. Its properties are consistent with a type 1 Seyfert nucleus viewed through an obscuration of $A_V = 28 \pm 7$ mag.

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Near-infrared photometry of isolated spirals with and without an AGN. II: Photometric properties of the host galaxies.

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We present here the analysis of morphological and photometric properties of a sample of isolated spirals with (18) and without (11) an active nucleus, based on near-infrared imaging in the J and K' bands (Paper I). The aim of that comparative analysis is to find the differential properties that could be directly connected with the phenomenon of nuclear activity. We stress the importance of using isolated objects for that purpose. Our study shows that both sets of galaxies are similar in their global properties: they define the same Kormendy relation, their disk components share the same properties, the bulge and disk scale lengths are correlated in a similar way, bar strengths and lengths are similar for primary bars. Our results therefore indicate that hosts of isolated Seyfert galaxies have bulge and disk properties comparable to those of isolated non active spirals. Central colors (the innermost 200 pc) of active galaxies are redder than the centers of non active spirals, most probably due to AGN light being re-emitted by the hot dust and/or due to circumnuclear star formation, through the contribution of giants/supergiants.

Central to our analysis is the study of the possible connection between bars and similar non axisymmetric structures with the nuclear fuelling. We notice that only one of the Seyfert galaxies in our sample, namely ESO 139-12, does not present a primary bar. But bars are equally present in active and control objects. The same applies to secondary bars. Not all the active galaxies we have observed have them, and some control galaxies also present such central structures. Secondary central elongations (associated with secondary bars, lenses, rings or disks) may be somewhat different, but this result should be confirmed with larger samples. We note that numerical models indicate that such secondary bars are not strictly necessary to feed the central engine when a primary bar is present. Our results show that down to scales of 100-300 pc, there are no evident differences between active and non active spiral galaxies.

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Integral field spectroscopy of the radio galaxy 3C 171

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We have performed integral field spectroscopy of the radio galaxy 3C 171 (redshift z=0.238) with the TIGER instrument at the Canada France Hawaii telescope in the Hβ-[OIII]4959-5007 wavelength region. We present the reconstructed Hβ and [OIII] images and compare them to the HST and radio maps. We discuss the variations of the [OIII]/Hβ line ratio throughout the nebulosity. We also analyze the velocity field in detail, in particular the presence of several components. We find that the kinematics derived with emission lines in the central region (inside 1 arcsec) are compatible with a disk-like rotation of low amplitude (50 km/s). The continuum surface brightness profile follows an $r^{1/4}$ law, suggesting that the underlying galaxy is an elliptical with an effective radius of 15 kpc.

We have fit two components in the region centered 2.7 arcsec to the West and of extension 3 arcsec^2. We find that the blueshifted component is an extension of the central part, whereas the second one is redshifted by 600 km/s. In both components, line ratios and FWHM are compatible with the presence of shocks induced by jet-cloud interactions.

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A Kinematic Model for the Narrow-Line Region in NGC 4151

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We present a simple kinematic model for the narrow-line region (NLR) of the Seyfert 1 galaxy NGC 4151, based on our previous observations of extended [O III] emission with the Space Telescope Imaging Spectrograph (STIS). The model is similar to a biconical radial outflow model developed for the Seyfert 2 galaxy NGC 1068, except that the bicone axis is tilted much more into our line of sight (40° out of the plane of the sky instead of 5°), and the maximum space velocities are lower (750 km s^{-1} instead of 1300 km s^{-1}). We find evidence for radial acceleration of the emission-line knots to a distance of 160 pc, followed by deceleration that approaches the systemic velocity at a distance of 290 pc (for a distance to NGC 4151 of 13.3 Mpc). Other similarities to the kinematics of NGC 1068 are: 1) there are a number of high-velocity clouds that are not decelerated, suggesting that the medium responsible for the deceleration is patchy, and 2) the bicone in NGC 4151 is at least partially evacuated along its axis. Together, these two Seyfert galaxies provide strong evidence for radial outflow (e.g., due to radiation and/or wind pressure) and against gravitational motion or expansion away from the radio jets as the principal kinematic component in the NLR.

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Resolved Spectroscopy of the Narrow-Line Region in NGC 1068: Kinematics of the Ionized Gas

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The physical conditions in the inner narrow line region (NLR) of the Seyfert 2 galaxy, NGC 1068, are examined using ultraviolet and optical spectra and photoionization models. The spectra were taken with the *Hubble Space Telescope*/Space Telescope Imaging Spectrograph (*HST*/STIS), through the $0''.1$X$52''.0$ slit, covering the full STIS 1200 Å to 10000 Å waveband. The slit was centered on a position $0''.14$ north of the optical continuum peak (or "hot spot") at a position angle (PA) of 202°, bisecting the brighter part of the biconical emission-line region. We have measured the emission-line fluxes for a region extending $3''.8$ northeast ($\sim$ 270 pc) to $1''.8$ southwest ($\sim$ 130 pc) of this point. The emission-lines on each side show evidence of two principal kinematic components, one blueshifted with respect to the systemic velocity and the other redshifted (the kinematics were discussed in a separate paper). Based on the photoionization modeling results we find that the physical conditions vary among these four quadrants. 1) The emission-line gas in the blueshifted northeast quadrant is photoionized by the hidden central source out to $\sim$ 100 pc, at which point we find evidence of another source of ionizing radiation, which may be due to fast ($\sim$ 1000 km s^{-1}) shocks resulting from the interaction of the emission-line knots and the interstellar medium. Interestingly, this occurs at approximately the location where the knots begin to show signs of deceleration. 2) The gas in the redshifted northeast quadrant is photoionized by continuum radiation that has been heavily absorbed by gas within $\sim$ 30 pc of the central source. We find no strong evidence of the effects of shocks in this component. 3) The redshifted emission-line gas in the southwest quadrant is photoionized by unabsorbed continuum from the central source, similar to that in the inner $\sim$ 100 pc of the blueshifted northeast quadrant. Finally, 4) the emission-line spectrum of the blueshifted southwest quadrant appears to be the superposition of highly ionized, tenuous component within the ionization cone and gas outside the cone, the latter photoionized by scattered continuum radiation.

There are several implications of this complicated physical scenario. First, the hidden active nucleus is the dominant source of ionizing radiation in the inner NLR. The absorption of continuum radiation along the line-of-sight to the redshifted northeast quadrant may result from the intersection of the ionization cone and the plane of the host galaxy. Finally, the evidence for shock-induced continuum radiation at the point where the emission-line knots begin to decelerate indicates that the deceleration is due to the interaction of emission-line knots with slower moving gas, such as the interstellar medium of NGC 1068.

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The Origin of the X-ray and Ultraviolet emission in NGC 7469

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We present a spectral analysis of a ~ 30 d, near-continuous observation of the Seyfert 1 galaxy NGC 7469 with RXTE. Daily integrations show strong spectral changes during the observation. Our main result is that we find the X-ray spectral index to be correlated with the UV flux. Furthermore, the *broad-band* X-ray photon flux is also correlated with the UV continuum. These correlations point towards a model in which the X-rays originate via thermal Comptonization of UV seed photons. Furthermore, the UV is also correlated with the extrapolation of the X-ray power law into the soft X-ray/EUV region. Our data analysis therefore re-opens the possibility the the UV photons and their variability arise from reprocessing, as long as the primary source of heating is photo-electric absorption in the reprocessor, rather than Compton downscattering, A coherent picture of the X-ray/UV variability can therefore be constructed whereby absorption and reprocessing of EUV/soft X-rays in a standard accretion disk produce a variable seed photon distribution which are in turn up-scattered into the X-ray band. We also find a significant correlation between the 2-10 keV flux and the 6.4 keV iron Kα line suggesting that at least some portion of the line originates within ~ 1 lt day of the X-ray continuum source. Neither the power law photon index nor the Compton reflection component are correlated with the 2-10 keV flux. The latter is not correlated with the iron Kα line flux either. We do find an apparent correlation between the X-ray spectral index and the strength of the Compton reflection component. In an Appendix we show, however, that this can be produced by a combination of statistical and systematic errors. We conclude the apparent variations in the Compton reflection component may be an artifact of these effects.

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Orientation effects on bent extragalactic jets

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We have investigated how varying several parameters affects the results of a collision between an extragalactic jet and a dense, intergalactic cloud, through a series of hydrodynamic simulations. We have produced synthetic radio images for comparison with observations. These show that a variety of structures may be produced from simple jet-cloud collisions. Moderate Mach numbers and density contrasts are needed to produce observable bends. We investigate the effect of viewing from various angles on the appearance of such sources.

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Jobs

Opening for a Brainpool position in AGN related fields

Korea Astronomy Observatory

KAO has an opening in a AGNs or Gaseous Nebulae working group. KAO is like KPNO in the U.S.A.

The position is available for a two year's period (with the option of a 3rd year). Salary varies depending on the research experience, approximately 2 500 000 -3 000 000 Won per month (∼30 000 USD per year). Health insurances and housing will be provided. Some travel money is also available.

The group is engaged in

1) quantitative spectral analysis of the Seyfert galaxies (e.g. CFHT/OASIS)
2) numerical simulation of AGNs (e.g. TVD/SPH)

Applicants must have more than 4–5 years' research experience after his PhD in AGN fields (observational or theoretically). Applicants are encouraged to contact informally before submitting the usual documents: the application procedure is to be done through the Korea Science and Engineering Federation (KOSEF), i.e., the funding agency. For further information, please contact Dr. Hyung at KAO 'http://www.kao.re.kr/∼hyung/'.

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