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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.

Please note that the web & email addresses for the Active Galaxies Newsletter has changed.

THE NEW EMAIL ADDRESS IS: agnews@manchester.ac.uk

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As always as editor of the newsletter I am very interested to hear any suggestions or feedback regarding the newsletter. So do not hesitate in emailing me your suggestions.

Many thanks for your continued subscription.

Rob Beswick

Abstracts of recently accepted papers

AGN dust tori at low and high luminosities

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A cornerstone of AGN unification schemes is the presence of an optically and geometrically thick dust torus. It provides the obscuration to explain the difference between type 1 and type 2 AGN. We investigate the influence of the dust distribution on the Eddington limit of the torus. For smooth dust distributions, the Eddingtion limit on the dust alone is 5 orders of magnitudes below the limit for electron scattering in a fully ionized plasma, while a clumpy dust torus has an Eddington limit slightly larger than the classical one. We study the behaviour of a clumpy torus at low and high AGN luminosities. For low luminosities of the order of $\sim 10^{42}$ erg/s, the torus changes its characteristics and obscuration becomes insufficient. In the high luminosity regime, the clumpy torus can show a behaviour which is consistent with the "receding torus" picture. The derived luminosity-dependent fraction of type-2-objects agrees with recent observational results. Moreover, the luminosity-dependent covering factor in a clumpy torus may explain the presence of broad-line AGN with high column densities in X-rays.

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E-mail contact: shoenig [at] mpifr-bonn.mpg.de,
preprint available at http://arxiv.org/abs/0707.0162

A *Chandra* study of particle acceleration in the multiple hotspots of nearby radio galaxies

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We present *Chandra* observations of a small sample of nearby classical double radio galaxies which have more than one radio hotspot in at least one of their lobes. The X-ray emission from the hotspots of these comparatively low-power objects is expected to be synchrotron in origin, and therefore to provide information about the locations of high-energy particle acceleration. In some models of the relationship between the jet and hotspot the hotspots that are not the current jet termination point should be detached from the energy supply from the active nucleus and therefore not capable of accelerating particles to high energies. We find that in fact some secondary hotspots are X-ray sources, and thus probably locations for high-energy particle acceleration after the initial jet termination shock. In detail, though, we show that the spatial structures seen in X-ray are not consistent with naïve expectations from a simple shock model: the current locations of the acceleration of the highest-energy observable particles in powerful radio galaxies need not be coincident with the peaks of radio or even optical emission.

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preprint available at http://arxiv.org/abs/0707.2865

Multiwavelength study of massive galaxies at $z \sim 2$. II. Widespread Compton-thick AGN and the concurrent growth of black holes and bulges

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Approximately 20–30% of $1.4 \lesssim z \lesssim 2.5$ galaxies with $K_{\rm Vega} < 22$ detected with Spitzer MIPS at $24\,\mu$m show excess mid-IR emission relative to that expected based on the rates of star formation measured from other multiwavelength data. These galaxies also display some near-IR excess in Spitzer IRAC data, with a spectral energy distribution peaking longward of 1.6μm in the rest frame, indicating the presence of warm-dust emission usually absent in star forming galaxies. Stacking *Chandra* data for the mid-IR excess galaxies yields a significant hard X-ray detection at rest-frame energies > 6.2 keV. The stacked X-ray spectrum rises steeply at > 10 keV, suggesting that these sources host Compton-thick Active Galactic Nuclei (AGNs) with column densities $N_{\rm H} \gtrsim 10^{24}$ cm^{-2} and an average, unobscured X-ray luminosity $L_{2-8\rm keV} \approx (1\text{–}4) \times 10^{43}$ erg s^{-1}. Their sky density (~ 3200 deg^{-2}) and space density ($\sim 2.6 \times 10^{-4}$ Mpc^{-3}) are twice those of X-ray detected AGNs at $z \approx 2$, and much larger than those of previously-known Compton thick sources at similar redshifts. The mid-IR excess galaxies are part of the long sought-after population of distant heavily obscured AGNs predicted by synthesis models of the X-ray background. The fraction of mid-IR excess objects increases with galaxy mass, reaching $\sim$ 50–60% for $M \sim 10^{11} M_\odot$, an effect likely connected with downsizing in galaxy formation. The ratio of the inferred black-hole growth rate from these Compton-thick sources to the global star formation rate at $z = 2$ is similar to the mass ratio of black holes to stars in local spheroids, implying concurrent growth of both within the precursors of today's massive galaxies.

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Circumnuclear Gas in Seyfert 1 Galaxies: Morphology, Kinematics, and Direct Measurement of Black Hole Masses

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The two-dimensional distribution and kinematics of the molecular, ionized, and highly ionized gas in the nuclear regions of Seyfert 1 galaxies have been measured using high spatial resolution ($\sim 0''.09$) near-infrared spectroscopy from NIRSPEC with adaptive optics on the Keck telescope. Molecular hydrogen, H_2, is detected in all nine Seyfert 1 galaxies and, in the majority of galaxies, has a spatially resolved flux distribution. In contrast, the narrow component of the Brγ emission has a distribution consistent with that of the K-band continuum. In general, the kinematics of the molecular hydrogen are consistent with thin disk rotation, with a velocity gradient of over 100 km s^{-1} measured across the central $0''.5$ in three galaxies, and a similar gradient across the central $1''.5$ in an additional two galaxies. The kinematics of Brγ are in agreement with the H_2 rotation, except in all four cases the central $0''.5$ is either blue- or redshifted by more than 75 km s^{-1}. The highly ionized gas, measured

with the [Ca VIII] and [Si VII] coronal lines, is spatially and kinematically consistent with Brγ in the central $0''.5$. In addition, the velocity dispersion of both the coronal and Brγ emission is greater than that of H_2 (by 1.3-2.0 times), suggesting that both originate from gas that is located closer to the nucleus than the H_2 line emitting gas. Dynamical models have been fitted to the two-dimensional H_2 kinematics, taking into account the stellar mass distribution, the emission line flux distribution, and the point spread function. For NGC 3227 the modeling indicates a black hole mass of $M_{BH}=2.0^{+1.0}_{-0.4} \times 10^7$ $M_\odot$, and for NGC 4151 $M_{BH}=3.0^{+0.75}_{-2.2} \times 10^7$ $M_\odot$. In NGC 7469 the best fit model gives $M_{BH} < 5.0 \times 10^7$ $M_\odot$. In all three galaxies, modeling suggests a near face-on disk inclination angle, which is consistent with the unification theory of active galaxies. The direct black hole mass estimates verify that estimates from the indirect technique of reverberation mapping are accurate to within a factor of two with no additional systematic errors.

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Nuclear spirals as feeding channels to the Supermassive Black Hole: the case of the galaxy NGC 6951

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We report the discovery of gas streaming motions along nuclear spiral arms towards the LINER nucleus of the galaxy NGC 6951. The observations, obtained using the GMOS integral field spectrograph on the Gemini North telescope, yielded maps of the flux distributions and gas kinematics in the Hα, [N II]λ6584 and [S II]$\lambda\lambda$6717,31 emission lines of the inner $7''\times15''$ of the galaxy. This region includes a circumnuclear star-forming ring with radius $\sim$500 pc, a nuclear spiral inside the ring and the LINER nucleus. The kinematics of the ionized gas is dominated by rotation, but subtraction of a kinematic model of a rotating exponential disk reveals deviations from circular rotation within the nuclear ring which can be attributed to (1) streaming motions along the nuclear spiral arms and (2) a bipolar outflow which seems to be associated to a nuclear jet. On the basis of the observed streaming velocities and geometry of the spiral arms we estimate a mass inflow rate of ionized gas of $\approx 3\times10^{-4} M_\odot\,\mathrm{yr}^{-1}$, which is of the order of the accretion rate necessary to power the LINER nucleus of NGC 6951. Similar streaming motions towards the nucleus of another galaxy with LINER nucleus – NGC 1097 – have been reported by our group in a previous paper. Taken together, these results support a scenario in which nuclear spirals are channels through which matter is transferred from galactic scales to the nuclear region to feed the supermassive black hole.

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