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Accepted Abstracts - Submitted Abstracts - Thesis Abstracts
Jobs Adverts - Meetings Adverts - Special Announcements

From the Editor

The Active Galaxies Newsletter is produced monthly. The deadline for contributions is the last day 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.

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.

Melanie Gendre

Abstracts of recently accepted papers

Feedback from Mass Outflows in Nearby Active Galactic Nuclei I. UV and X-ray Absorbers

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We present an investigation into the impact of feedback from outflowing UV and X-ray absorbers in nearby ($z < 0.04$) AGN. From studies of the kinematics, physical conditions, and variability of the absorbers in the literature, we calculate the possible ranges in total mass outflow rate ($\dot{M}_{out}$) and kinetic luminosity (L_{KE}) for each AGN, summed over all of its absorbers. These calculations make use of values (or limits) for the radial locations of the absorbers determined from variability, excited-state absorption, and other considerations. From a sample of 10 Seyfert 1 galaxies with detailed photoionization models for their absorbers, we find that 7 have sufficient constraints on the absorber locations to determine $\dot{M}_{out}$ and L_{KE}. For the low-luminosity AGN NGC 4395, these values are low, although we do not have sufficient constraints on the X-ray absorbers to make definitive conclusions. At least 5 of the 6 Seyfert 1s with moderate bolometric luminosities ($L_{bol} = 10^{43} - 10^{45}$ ergs s^{-1}) have mass outflow rates that are 10 – 1000 times the mass accretion rates needed to generate their observed luminosities, indicating that most of the mass outflow originates from outside the inner accretion disk. Three of these (NGC 4051, NGC 3516, and NGC 3783) have L_{KE} in the range 0.5 – 5% L_{bol}, which is the range typically required by feedback models for efficient self-regulation of black-hole and galactic bulge growth. At least 2 of the other 3 (NGC 5548, NGC 4151, and NGC 7469) have $L_{KE} \geq 0.1\% L_{bol}$, although these values may increase if radial locations can be determined for more of the absorbers. We conclude that the outflowing UV and X-ray absorbers in moderate-luminosity AGN have the potential to deliver significant feedback to their environments.

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A POPULATION OF DUST-RICH QUASARS AT $z \sim 1.5$

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We report *Herschel*[1] SPIRE (250, 350, and 500 μm) detections of 32 quasars with redshifts $0.5 \leq z < 3.6$ from the *Herschel* Multi-tiered Extragalactic Survey (HerMES[2]). These sources are from a MIPS 24 μm flux-limited sample of 326 quasars in the Lockman Hole Field. The extensive multi-wavelength data available in the field permit construction of the rest-frame spectral energy distributions (SEDs) from ultraviolet to the mid-infrared for all sources, and to the far-infrared (FIR) for the 32 objects. Most quasars with *Herschel* FIR detections show dust temperatures in the range of 25 K – 60 K, with a mean of 34K. The FIR luminosities range from $10^{11.3}$ to $10^{13.5}$ solar luminosity, qualifying most of their hosts as ultra- or hyper-luminous infrared galaxies. These FIR-detected quasars may represent a dust-rich population, but with lower redshifts and fainter luminosities than quasars observed at ~ 1 mm. However, their FIR properties cannot be predicted from shorter wavelengths (0.3–20 μm, rest frame), and the bolometric luminosities derived using the 5100 Å index may be underestimated for these FIR-detected quasars. Regardless of redshift, we observed a decline in the relative strength of FIR luminosities for quasars with higher near-infrared luminosities.

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[1] *Herschel* is a ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA.

[2]http://hermes.sussex.ac.uk

The Lick AGN Monitoring Project 2011: Dynamical Modeling of the Broad Line Region in Mrk 50

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We present dynamical modeling of the broad line region (BLR) in the Seyfert 1 galaxy Mrk 50 using reverberation mapping data taken as part of the Lick AGN Monitoring Project (LAMP) 2011. We model the reverberation mapping data directly, constraining the geometry and kinematics of the BLR, as well as deriving a black hole mass estimate that does not depend on a normalizing factor or virial coefficient. We find that the geometry of the BLR in Mrk 50 is a nearly face-on thick disk, with a mean radius of $9.6^{+1.2}_{-0.9}$ light days, a width of the BLR of $6.9^{+1.2}_{-1.1}$ light days, and a disk opening angle of 25 ± 10 degrees above the plane. We also constrain the inclination angle to be 9^{+7}_{-5} degrees, close to face-on. Finally, the black hole mass of Mrk 50 is inferred to be $\log_{10}(M_{\rm BH}/M_{\odot}) = 7.57^{+0.44}_{-0.27}$. By comparison to the virial black hole mass estimate from traditional reverberation mapping analysis, we find the normalizing constant (virial coefficient) to be $\log_{10} f = 0.78^{+0.44}_{-0.27}$, consistent with the commonly adopted mean value of 0.74 based on aligning the $M_{\rm BH}$-σ^* relation for AGN and quiescent galaxies. While our dynamical model includes the possibility of a net inflow or outflow in the BLR, we cannot distinguish between these two scenarios.

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Exploring the relation between (sub-)millimeter radiation and γ-ray emission in blazars with *Planck* and *Fermi*

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The coexistence of *Planck* and *Fermi* satellites in orbit has enabled the exploration of the connection between the (sub-)millimeter and γ-ray emission in a large sample of blazars. We find that the γ-ray emission and the (sub-)mm luminosities are correlated over five orders of magnitude, $L_\gamma \propto L_{(sub-)mm}$. However, this correlation is not significant at some frequency bands when simultaneous observations are considered. The most significant statistical correlations, on the other hand, arise when observations are quasi-simultaneous within 2 months. Moreover, we find that sources with an approximate spectral turnover in the middle of the mm-wave regime are more likely to be strong γ-ray emitters. These results suggest a physical relation between the newly injected plasma components in the jet and the high levels of γ-ray emission.

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The nature of the jet-driven outflow in the radio galaxy 3C 305

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We present *Chandra* X-ray and VLA radio observations of the radio galaxy 3C 305. The X-ray observations reveal the details of the previously known extended X-ray halo around the radio galaxy. We show using X-ray spectroscopy that the X-ray emission is consistent with being shock-heated material and can be modelled with standard collisional-ionization models, rather than being photoionized by the active nucleus. On this basis, we can make a self-consistent model in which the X-ray-emitting plasma is responsible for the depolarization of some regions of the radio emission from the jets and hotspots, and to place lower and upper limits on the magnetic field strength in the depolarizing medium. On the assumption that the X-ray-emitting material, together with the previously-known extended emission-line region and the outflow in neutral hydrogen, are all being driven out of the centre of the galaxy by an interaction with the jets, we derive a detailed energy budget for the radio galaxy, showing that the X-ray-emitting gas dominates the other phases in terms of its energy content. The power supplied by the jets must be $\sim 10^{43}$ erg s^{-1}.

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Chandra Observations of the Nuclear Star Cluster and Ultraluminous X-ray Sources in NGC 2139

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We report *Chandra* observations of the Scd galaxy NGC 2139, which is known to host a recently formed ($10^{7.6}$ yrs) nuclear star cluster. The star cluster is undetected in X-rays, with an upper bound on 0.5-7 keV luminosity of $L_{\rm X} < 7.1 \times 10^{37}$ erg s^{-1}. This bound implies a bolometric accretion luminosity $< 0.3\%$ of the Eddington luminosity for a black hole with the mass (~ 3400 M$_\odot$) expected from extrapolation of the $M - \sigma$ relation. The lack of X-ray emission indicates that a black hole, if present, is not undergoing significant accretion at the current time. While the central cluster is undetected, the data reveal a substantial population of bright X-ray point sources elsewhere in this galaxy, with eight qualifying as ultraluminous X-ray sources with $L_{\rm X} > 10^{39}$ erg s^{-1}. We use archival *Hubble Space Telescope* images to identify candidate optical counterparts for seven *Chandra* sources, which in most cases have optical luminosities and spatial profiles consistent with star clusters. Compared with other galaxies, the number of luminous X-ray sources in NGC 2139 is larger by a factor of $\sim 4-10$ than expected based on its present star formation rate and stellar mass. This finding can be understood if NGC 2139 has concluded a burst of star formation in the recent past, and suggests that this galaxy could be important for testing the use of X-ray source populations as a chronometer of star formation history.

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Fundamental properties of Fanaroff-Riley II radio galaxies investigated via Monte Carlo simulations

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Radio galaxies and quasars are among the largest and most powerful single objects known and are believed to have had a significant impact on the evolving Universe and its large scale structure. We explore the intrinsic and extrinsic properties of the population of Fanaroff-Riley II (FR II) objects, that is their kinetic luminosities, lifetimes, and the central densities of their environments. In particular, the radio and kinetic luminosity functions of these powerful radio sources are investigated using the complete, flux limited radio catalogues of 3CRR and Best et al.. We construct multidimensional Monte Carlo simulations using semi-analytical models of FR II source time evolution to create artificial samples of radio galaxies. Unlike previous studies, we compare radio luminosity functions found with both the observed and simulated data to explore the best-fitting fundamental source parameters. The new Monte Carlo method we present here allows us to: (i) set better limits on the predicted fundamental parameters of which confidence intervals estimated over broad ranges are presented, and (ii) generate the most plausible underlying parent populations of these radio sources. Moreover, as has not been done before, we allow the source physical properties (kinetic luminosities, lifetimes and central densities) to co-evolve with redshift, and we find that all the investigated parameters most likely undergo cosmological evolution. Strikingly, we find that the break in the kinetic luminosity function must undergo redshift evolution of at least $(1 + z)^3$. The fundamental parameters are strongly degenerate, and independent constraints are necessary to draw more precise conclusions. We use the estimated kinetic luminosity functions to set constraints on the duty cycles of these powerful radio sources. A comparison of the duty cycles of powerful FR IIs with those determined from radiative luminosities of AGN of comparable black hole mass suggests a transition in behaviour from high to low redshifts, corresponding to either a drop in the typical black hole mass of powerful FR IIs at low redshifts, or a transition to a kinetically-dominated, radiatively-inefficient FR II population.

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