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Jobs Adverts - Meetings Adverts - Special Announcements

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.

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.

Janine van Eymeren

Neutral Gas Outflows and Inflows in Infrared-Faint Seyfert Galaxies

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Previous studies of the Na I D interstellar absorption line doublet have shown that galactic winds occur in most galaxies with high infrared luminosities. However, in infrared-bright composite systems where a starburst coexists with an active galactic nucleus (AGN), it is unclear whether the starburst, the AGN, or both are driving the outflows. The present paper describes the results from a search for outflows in 35 infrared-faint Seyferts with $10^{9.9} < L_{\rm IR}/L_{\odot} < 10^{11}$, or, equivalently, star formation rates (SFR) of $\sim$0.4 – 9 $M_{\odot}$ yr^{-1}, to attempt to isolate the source of the outflow. We find that the outflow detection rates for the infrared-faint Seyfert 1s (6%) and Seyfert 2s (18%) are lower than previously reported for infrared-luminous Seyfert 1s (50%) and Seyfert 2s (45%). The outflow kinematics of infrared-faint and infrared-bright Seyfert 2 galaxies resemble those of starburst galaxies, while the outflow velocities in Seyfert 1 galaxies are significantly larger. Taken together, these results suggest that the AGN does not play a significant role in driving the outflows in most infrared-faint and infrared-bright systems, except the high-velocity outflows seen in Seyfert 1 galaxies. Another striking result of this study is the high rate of detection of inflows in infrared-faint galaxies (39% of Seyfert 1s, 35% of Seyfert 2s), significantly larger than in infrared-luminous Seyferts (15%). This inflow may be contributing to the feeding of the AGN in these galaxies, and potentially provides more than enough material to power the observed nuclear activity over typical AGN lifetimes.

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The Geometry of Mass Outflows and Fueling Flows in the Seyfert 2 Galaxy Mrk 3

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We present a study of the resolved emission-line regions and an inner dust/gas disk in the Seyfert 2 galaxy Mrk 3, based on *Hubble Space Telescope* observations. We show that the extended narrow-line region (ENLR), spanning ∼4 kpc, is defined by the intersection of the ionizing bicone of radiation from the AGN and the inner disk, which is not coplanar with the large-scale stellar disk. This intersection leads to different position and opening angles of the ENLR compared to the narrow-line region (NLR). A number of emission-line arcs in the ENLR appear to be continuations of dust lanes in the disk, supporting this geometry. The NLR, which consists of outflowing emission-line knots spanning the central ∼650 pc, is in the shape of a backwards S. This shape may arise from rotation of the gas, or it may trace the original fueling flow close to the nucleus that was ionized after the AGN turned on.

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Variability and stability in blazar jets on time scales of years: Optical polarization monitoring of OJ287 in 2005–2009

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OJ287 is a BL Lac object at redshift $z = 0.306$ that has shown double-peaked bursts at regular intervals of ~ 12 yr during the last ~ 40 yr. We analyse optical photopolarimetric monitoring data from 2005–2009, during which the latest double-peaked outburst occurred. The aim of this study is twofold: firstly, we aim to analyse variability patterns and statistical properties of the optical polarization light-curve. We find a strong preferred position angle in optical polarization. The preferred position angle can be explained by separating the jet emission into two components: an optical polarization core and chaotic jet emission. The optical polarization core is stable on time scales of years and can be explained as emission from an underlying quiescent jet component. The chaotic jet emission sometimes exhibits a circular movement in the Stokes plane. We find six such events, all on the time-scales of 10–20 days. We interpret these events as a shock front moving forwards and backwards in the jet, swiping through a helical magnetic field. Secondly, we use our data to assess different binary black hole models proposed to explain the regularly appearing double-peaked bursts in OJ287. We compose a list of requirements a model has to fulfil to explain the mysterious behaviour observed in OJ287. The list includes not only characteristics of the light-curve but also other properties of OJ287, such as the black hole mass and restrictions on accretion flow properties. We rate all existing models using this list and conclude that none of the models is able to explain all observations. We discuss possible new explanations and propose a new approach to understanding OJ287. We suggest that both the double-peaked bursts and the evolution of the optical polarization position angle could be explained as a sign of resonant accretion of magnetic field lines, a 'magnetic breathing' of the disc.

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Power for dry BL Lacs

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Is it significant that the intrinsic outputs of several BL Lacs are observed to level off at values of about 10^{46} erg s^{-1}? In searching for an answer, we compare γ-ray observations by the *AGILE* satellite of the BL Lac S5 0716+714 with those of Mrk 421 and Mrk 501; the former are particularly marked by intense flares up to fluxes of 2×10^{-6} photons cm^{-2} s^{-1} in the $0.1 - 10$ GeV energy range. These "dry" BL Lacs show evidence of neither thermal disk emissions nor emission lines signaling any accreting or surrounding gas; the spectral distributions of their pure non-thermal radiations are effectively represented by the synchrotron self-Compton process. With source parameters correspondingly derived and tuned with simultaneous multiwavelength observations, we find for S5 0716+714 a total jet power of about 3×10^{45} erg s^{-1}, which makes it one of the brightest dry BL Lacs so far detected in γ rays. We evaluate the mass of the associated Kerr hole to be around $5 \times 10^{8} M_{\odot}$, implying that the source is significantly gauged in terms of the maximal power around 4×10^{45} erg s^{-1} extractable via the Blandford-Znajek electrodynamical mechanism; other dry BL Lacs observed in γ rays remain well below that threshold. These findings and those forthcoming from *Fermi*-LAT will provide a powerful test of electrodynamics in the surroundings of the hole, that are dominated by GR effects.

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Infrared Diagnostics for the Extended 12 micron Sample of Seyferts

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We present an analysis of Spitzer IRS spectroscopy of 83 active galaxies from the extended 12 micron sample. We find rank correlations between several tracers of star formation which suggest that (1) the PAH feature is a reliable tracer of star formation, (2) there is a significant contribution to the heating of the cool dust by stars, (3) the H_2 emission is also primarily excited by star formation. The 55-90 vs. 20-30 spectral index plot is also a diagnostic of the relative contribution of Starburst to AGN. We see there is a large change in spectral index across the sample. Thus, the contribution to the IR spectrum from the AGN and starburst components can be comparable in magnitude but the relative contribution also varies widely across the sample. We find rank correlations between several AGN tracers. We search for correlations between AGN and Starburst tracers and we conclude that the AGN and Starburst tracers are not correlated. This is consistent with our conclusion that the relative strength of the AGN and Starburst components varies widely across the sample. Thus, there is no simple link between AGN fueling and Black Hole Growth and star formation in these galaxies. The distribution of Sil 10 micron and 18 micron strengths is consistent with the clumpy torus models of Sirocky et al. We find a rank correlation between the [NeV] 14 micron line and the 6.7 micron continuum which may be due to an extended component of hot dust. The Sy 2s with a Hidden Broad Line Region (HBLR) have a higher ratio of AGN to Starburst contribution to the SED than Sy 2s without an HBLR. This may contribute to the detection of the HBLR in polarized light. The Sy 2s with an HBLR are more similar to the Sy 1s than they are to the Sy 2s without an HBLR.

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Spectral variability and reverberation time delays in the Suzaku X-ray spectrum of NGC 4051

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Long Suzaku X-ray observations of the active galaxy NGC 4051 from 2005 and 2008 are analysed, in an attempt to reach a self-consistent understanding of the spectral variability on long timescales and at high time resolution. Principal components analysis and a maximum likelihood method of power spectrum analysis are used. In common with other type I AGN, the spectral variability is dominated by a varying-normalisation power-law component together with a quasi-steady, hard-spectrum offset component that contains Fe K atomic features. NGC 4051 displays a strong excess over a power-law at energies above 20 keV, some fraction of which also appears to vary with the power-law continuum. The power spectrum has a shape consistent with previous determinations, but significant differences are found between the low and high flux states of the source, demonstrating that the power spectrum is non-stationary. Frequency-dependent time lags between the hard and soft bands of up to 970+/-225s are measured. The existence of the observed lags excludes the possibility that the hard spectral component originates as reflection from the inner accretion disk. We instead show that the frequency- and energy-dependent time lags may be explained as reverberation, caused by reflection from a thick shell of material with maximum lags of about 10,000s. If the reflecting material surrounds the AGN, it extends to a distance about 1.5×10^{14} cm, 600 gravitational radii, from the illuminating source and the global covering factor is C(g) > 0.4, confirming suggestions that type I AGN have high covering factors of absorbing and reflecting material. Given the spectral and timing similarities with other type I AGN, we infer that this structure is common in the type I population.

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Cosmic Ray Spallation in Radio-Quiet Active Galactic Nuclei: A Case Study of NGC 4051

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We investigate conditions for and consequences of spallation in radio-quiet Seyfert galaxies. The work is motivated by the recent discovery of significant line emission at 5.44 keV in Suzaku data from NGC 4051. The energy of the new line suggests an identification as Cr I Kα emission, however the line is much stronger than would be expected from material with cosmic abundances, leading to a suggestion of enhancement owing to nuclear spallation of Fe by low energy cosmic rays from the active nucleus. We find that the highest abundance enhancements are likely to take place in gas out of the plane of the accretion disk and that timescales for spalla tion could be as short as a few years. The suggestion of a strong nuclear flux of cosmi c rays in a radio-quiet Seyfert galaxy is of particular interest in light of the recent suggestion from *Pierre Auger Observatory* data that ultra-high-energy cosmic rays may originate in such sources.

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The XMM-*Newton* Wide Angle Survey (XWAS): the X-ray spectrum of type-1 AGN

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We discuss the broad band X-ray properties of one of the largest samples of X-ray selected type-1 AGN to date (487 objects in total), drawn from the XMM-*Newton* Wide Angle Survey (XWAS). The objects presented in this work cover 2-10 keV (rest-frame) luminosities from $\sim 10^{42} - 10^{45}\,\mathrm{erg\,s^{-1}}$ and are detected up to redshift ∼4. We constrain the overall properties of the broad band continuum, soft excess and X-ray absorption, along with their dependence on the X-ray luminosity and redshift. We discuss the implications for models of AGN emission. We fitted the observed 0.2-12 keV broad band spectra with various models to search for X-ray absorption and soft excess. The F-test was used with a significance threshold of 99% to statistically accept the detection of additional spectral components. We constrained the mean spectral index of the broad band X-ray continuum to $\langle\Gamma\rangle = 1.96 \pm 0.02$ with intrinsic dispersion $\sigma_{\langle\Gamma\rangle} = 0.27^{+0.01}_{-0.02}$. The continuum becomes harder at faint fluxes and at higher redshifts and hard (2-10 keV) luminosities. The dependence of Γ with flux is likely due to undetected absorption rather than to spectral variation. We found a strong dependence of the detection efficiency of objects on the spectral shape. We expect this effect to have an impact on the measured mean continuum shapes of sources at different redshifts and luminosities. We detected excess absorption in >3% of our objects, with rest-frame column densities ∼a few $\times 10^{22}\,\mathrm{cm^{-2}}$. The apparent mismatch between the optical classification and X-ray properties of these objects is a challenge for the standard orientation-based AGN unification model. We found that the fraction of objects with detected soft excess is ∼36%. Using a thermal model, we constrained the soft excess mean rest-frame temperature and intrinsic dispersion to kT∼100 eV and σ_{kT} ∼34 eV. The origin of the soft excess as thermal emission from the accretion disk or Compton scattered disk emission is ruled out on the basis of the temperatures detected and the lack of correlation of the soft excess temperature with the hard X-ray luminosity over more than 2 orders of magnitude in luminosity. Furthermore, the high luminosities of the soft excess rule out an origin in the host galaxy.

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Jobs

Assistant Professor of Astronomy

Department of Physics and Astronomy
Georgia State University

The Department of Physics and Astronomy anticipates filling a tenure track position in extragalactic astronomy at the rank of Assistant Professor for the 2010-11 academic year. The department presently includes 9 faculty members in astronomy with 3 in the extragalactic field (Dick Miller, Paul Wiita, and Mike Crenshaw). The successful applicant should have the following minimum requirements: (1) Ph.D. degree in astronomy, astrophysics or related field; (2) post-doctoral and research/teaching experience commensurate with rank; and (3) evidence of the ability to establish and maintain a successful research program in extragalactic astronomy which complements existing research programs in the department. In order to receive full consideration, applications should be received by Jan 31, 2010 and should include a cover letter, CV, the names of three references, statements of the candidate's teaching philosophy, research interests, and a description of how their research program would complement existing research programs in astronomy at GSU. These materials should be sent to the attention of H. Richard Miller, Dept. of Physics and Astronomy, Georgia State University, University Plaza, Atlanta, GA 30303. The email submission address is miller@chara.gsu.edu. This position will remain open until filled. For more information on the astronomy program at GSU, see http://www.chara.gsu.edu/. An offer of employment will be conditional on background verification. Georgia State University, a unit of the University System of Georgia, is an equal opportunity educational institution, and an EEO/AA employer.

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