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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

The Size, Structure and Ionization of the Broad Line Region in NGC 3227

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Hubble Space Telescope (*HST*) spectroscopy of the Seyfert 1.5 galaxy, NGC 3227, confirms previous reports that the broad Hα emission line flux is time variable, decreasing by a modest $\sim$ 13% between 1999 and 2000 in response to a corresponding $\sim$ 40% decrease in the underlying continuum. Modeling the gas distribution responsible for the broad Hα, Hβ and Hγ emission lines favors a spherically symmetric inflow as opposed to a thin disk. Adopting a central black hole mass of 7.6 $\times$ 10^6 M$_\odot$, determined from prior reverberation mapping, leads to the following dimensions for the size of the region emitting the broad Hα line; an outer radius $\sim$ 60 l.d and an inner radius $\sim$ 4 l.d. Thus, the previously determined reverberation size for the broad line region (BLR) consistently coincides with the inner radius of a much *larger* volume of ionized gas. However, the *perceived* size of the BLR is an illusion, a consequence of the fact that the emitting region is ionization bounded at the outer radius and diminished by Doppler broadening at the inner radius. The actual dimensions of the inflow remain to be determined. Nevertheless, the steady state mass inflow rate is estimated to be $\sim$1 $\times$ 10^{-2} M$_\odot$ yr^{-1} which is sufficient to explain the X-ray luminosity of the AGN in terms of radiatively inefficient accretion. Collectively, the results challenge many preconceived notions concerning the nature of BLRs in active galactic nuclei.

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CLaSPS: knowledge extraction from astronomical datasets

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In this paper we present the Clustering-Labels-Score Patterns Spotter (CLaSPS), a new methodology for the determination of correlations among astronomical observables in complex datasets, based on the application of distinct unsupervised clustering techniques. The novelty in CLaSPS is the criterion used for the selection of the optimal clusterings, based on a quantitative measure of the degree of correlation between the cluster memberships and the distribution of a set of observables, the *labels*, not employed for the clustering.CLaSPS has been primarily developed as a tool to tackle the challenging complexity of the multi-wavelength complex and massive astronomical datasets produced by the federation of the data from modern automated astronomical facilities. In this paper we discuss the applications of CLaSPS to two simple astronomical datasets, both composed of extragalactic sources with photometric observations at different wavelengths from large area surveys. The first dataset, CSC+, is composed of optical quasarsspectroscopically selected in the SDSS data, observed in the X-rays by Chandra and with multi-wavelength observations in the near-infrared, optical and ultraviolet spectral intervals. One of the results of the application of CLaSPS to the CSC+ is the re-identification of a well-known correlation between the $\alpha_{\rm OX}$ parameter and the near ultraviolet color, in a subset of CSC+ sources with relatively small values of the near-ultraviolet colors.The other dataset consists of a sample of blazars for which photometric observations in the optical, mid and near infrared are available, complemented for a subset of the sources, by Fermi γ-ray data. The main results of the application of CLaSPS to such datasets have been the discovery of a strong correlation between the multi-wavelength color distribution of blazars and their optical spectral classification in BL Lacs and Flat Spectrum Radio Quasars (FSRQs)and a peculiar pattern followed by blazars in the WISE mid-infrared colors space. This pattern and its physical interpretation have been discussed in details in other papers by one of the authors.

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The Importance of Broad Emission-Line Widths in Single Epoch Black Hole Mass Estimates

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Estimates of the mass of super-massive black holes (BHs) in distant active galactic nuclei (AGNs) can be obtained efficiently only through single-epoch spectra, using a combination of their broad emission-line widths and continuum luminosities. Yet the reliability and accuracy of the method, and the resulting mass estimates, $M_{\rm BH}$, remain uncertain. A recent study by Croom using a sample of SDSS, 2QZ and 2SLAQ quasars suggests that line widths contribute little information about the BH mass in these single-epoch estimates and can be replaced by a constant value without significant loss of accuracy. In this Letter, we use a sample of nearby reverberation-mapped AGNs to show that this conclusion is not universally applicable. We use the bulge luminosity ($L_{\rm Bulge}$) of these local objects to test how well the known $M_{\rm BH} - L_{\rm Bulge}$ correlation is recovered when using randomly assigned line widths instead of the measured ones to estimate $M_{\rm BH}$. We find that line widths provide significant information about $M_{\rm BH}$, and that for this sample, the line width information is just as significant as that provided by the continuum luminosities. We discuss the effects of observational biases upon the analysis of Croom and suggest that the results can probably be explained as a bias of flux-limited, shallow quasar samples.

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Activity restart – a key to explaining the morphology of J1211+743

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J1211+743 is a giant radio galaxy with a one-sided jet and two asymmetric lobes, one of which is of Fanaroff-Riley (FR) type II with a hotspot and the other is a diffuse relic devoid of a hotspot. The jet points towards the latter lobe, which is difficult to explain in a standard way within the double-lobed radio source paradigm. Here, I propose to assume that the nucleus of J1211+743 has undergone a re-ignition of activity and its lobes, presumably both originally of FR II type, represent an earlier active phase, while the jet represents the current one. The asymmetry of the lobes is a consequence of the orientation of the source combined with an activity switch-off that occurred between two active periods. The relic lobe is on the near side with regard to the observer, whereas the radiation from the far-side lobe arrives significantly later owing to its longer distance to the observer. The far-side lobe is thus perceived to have not yet decayed. On the other hand, the jet behaves in a standard way, i.e. its projected orientation reflects the near side of the source. Hence, we are able to explain why the location of the relic lobe correlates with the direction of the jet.

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The Mean Star Formation Rate of X-ray selected Active Galaxies and its Evolution from $z \sim 2.5$: Results from PEP-Herschel

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We study relationships between star-formation rate (SFR) and the accretion luminosity and nuclear obscuration of X-ray selected Active Galactic Nuclei (AGNs) using a combination of deep far-infrared (FIR) and X-ray data in three key extragalactic survey fields (GOODS-South, GOODS-North and COSMOS), as part of the PACS Evolutionary Probe (PEP) program. The use of three fields with differing areas and depths enables us to explore trends between the global FIR luminosity of the AGN hosts and the luminosity of the active nucleus across 4.5 orders of magnitude in AGN luminosity (L_{AGN}) and spanning redshifts from the Local Universe to $z = 2.5$. Using imaging from the Herschel/PACS instrument in 2-3 bands, we combine FIR detections and stacks of undetected objects to arrive at mean fluxes for subsamples in bins of redshift and X-ray luminosity. We constrain the importance of AGN-heated dust emission in the FIR and confirm that the majority of the FIR emission of AGNs is produced by cold dust heated by star-formation in their host galaxies. We uncover characteristic trends between the mean FIR luminosity (L_{60}) and accretion luminosity of AGNs, which depend both on L_{AGN} and redshift. At low AGN luminosities, accretion and SFR are uncorrelated at all redshifts, consistent with a scenario where most low-luminosity AGNs are primarily fueled by secular processes in their host galaxies. At high AGN luminosities, a significant correlation is observed between L_{60} and L_{AGN}, but only among AGNs at low and moderate redshifts ($z < 1$). We interpret this observation as a sign of the increasing importance of major-mergers in driving both the growth of super-massive black holes (SMBHs) and global star-formation in their hosts at high AGN luminosities. We also find evidence that the enhancement of SFR in luminous AGNs weakens or disappears at high redshifts ($z > 1$) suggesting that the role of mergers is less important at these epochs. At all redshifts, we find essentially no relationship between L_{60} and nuclear obscuration across five orders of magnitude in obscuring Hydrogen column density (N_H), suggesting that various mechanisms are likely to be responsible for obscuring X-rays in active galaxies. We discuss a broad scenario which can account for these trends: one in which two different modes of AGN fueling operate in the low- and high-luminosity regimes of SMBH accretion. We postulate that the dominant mode of accretion among high-luminosity AGNs evolves with redshift. Our study, as well as a body of evidence from the literature and emerging knowledge about the properties of high redshift galaxies, supports this scenario.

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HS 1700+6416: the first high redshift unlensed NAL-QSO showing variable high velocity outflows

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We present a detailed analysis of the X-ray emission of HS 1700+6416, a high-redshift ($z = 2.7348$) luminous quasar classified as a narrow absorption line (NAL) quasar on the basis of its SDSS spectrum.The source has been observed nine times by *Chandra* and once by XMM-*Newton* from 2000 to 2007.Long-term variability is clearly detected between the observations in the 2-10 keV flux where it varies by a factor of three ($\sim 3 - 9 \times 10^{-14}$ erg s^{-1} cm^{-2}), and in the amount of neutral absorption ($N_H < 10^{22}$ cm^{-2} in 2000 and 2002 and $N_H = 4.4 \pm 1.2 \times 10^{22}$ cm^{-2} in 2007).Most interestingly, one broad absorption feature is clearly detected at 10.3 ± 0.7 keV (rest frame) in the 2000 *Chandra* observation, while two similar features at 8.9 ± 0.4 and at 12.5 ± 0.7 keV are visible when the eight contiguous *Chandra* observations of 2007 are stacked together. In the XMM-*Newton* observation of 2002, which is strongly affected by background flares, there is a hint of a similar feature at 8.0 ± 0.3 keV.We interpreted these features as absorption lines from a high-velocity highly ionized (i.e. Fe XXV, FeXXVI) outflowing gas.In this scenario, the outflow velocities inferred are in the range v= $0.12 - 0.59$c.To reproduce the observed features, the gas must have a high column density ($N_H > 3 \times 10^{23}$ cm^{-2}),high ionization parameter (log$\xi > 3.3$ erg cm s^{-1}) and a wide range of velocities ($\Delta V \sim 10^4$ km s^{-1}).This absorption line quasar is the fourth high-z quasar that displays X-ray signatures of variable high-velocity outflows, and among these, it is the only one that is not lensed.A rough estimate of the minimum kinetic energy carried by the wind of up to 18% L_{bol}, based on a biconical geometry of the wind, implies that the amount of energy injected into the outflow environment is large enough to produce effective mechanical feedback.

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Heavily Obscured Quasar Host Galaxies at $z \sim 2$ are Disks, Not Major Mergers[1]

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We explore the nature of heavily obscured quasar host galaxies at $z \sim 2$ using deep *Hubble Space Telescope* WFC3/IR imaging of 28 Dust Obscured Galaxies (DOGs) to investigate the role of major mergers in driving black hole growth. The high levels of obscuration of the quasars selected for this study act as a natural coronagraph, blocking the quasar light and allowing a clear view of the underlying host galaxy. The sample of heavily obscured quasars represents a significant fraction of the cosmic mass accretion on supermassive black holes as the quasars have inferred bolometric luminosities around the break of the quasar luminosity function. We find that only a small fraction (4%, at most 11-25%) of the quasar host galaxies are major mergers. Fits to their surface brightness profiles indicate that 90% of the host galaxies are either disk dominated, or have a significant disk. This disk-like host morphology, and the corresponding weakness of bulges, is evidence against major mergers and suggests that secular processes are the predominant driver of massive black hole growth. Finally, we suggest that the co-incidence of mergers and AGN activity is luminosity dependent, with only the most luminous quasars being triggered mostly by major mergers.

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Two-dimensional mapping of young stars in the inner 180 pc of NGC 1068: correlation with molecular gas ring and stellar kinematics

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We report the first two-dimensional mapping of the stellar population and non-stellar continua within the inner 180 pc (radius) of NGC 1068 at a spatial resolution of 8 pc, using integral field spectroscopy in the near-infrared. We have applied the technique of spectral synthesis to data obtained with the instrument NIFS and the adaptive optics module ALTAIR at the Gemini North Telescope. Two episodes of recent star formation are found to dominate the stellar population contribution: the first occurred 300 Myr ago, extending over most of the nuclear region; the second occurred just 30 Myr ago, in a ring-like structure at $\approx$100 pc from the nucleus, where it is coincident with an expanding ring of H_2 emission. Inside the ring, where a decrease in the stellar velocity dispersion is observed, the stellar population is dominated by the 300 Myr age component. In the inner 35 pc, the oldest age component (age $\geq$ 2 Gyr) dominates the mass, while the flux is dominated by black-body components with temperatures in the range $700 \leq T \leq 800$ K which we attribute to the dusty torus. We also find some contribution from black-body and power-law components beyond the nucleus which we attribute to dust emission and scattered light.

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