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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

Spatially Resolved Spectroscopy of SDSS J0952+2552: a confirmed Dual Active Galactic Nucleus

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Most massive galaxies contain supermassive black holes (SMBHs) in their cores. When galaxies merge, gas is driven to nuclear regions and can accrete onto the central black hole. Thus, one expects to see dual active galactic nuclei (AGNs) in a fraction of galaxy mergers. Candidates for galaxies containing dual AGNs have been identified by the presence of double-peaked narrow [O III] emission lines and by high spatial resolution images of close galaxy pairs. Spatially resolved spectroscopy is needed to confirm these galaxy pairs as systems with spatially separated double SMBHs. With the Keck 2 Laser Guide Star Adaptive Optics system and the OH Suppressing InfraRed Imaging Spectrograph near-infrared integral field spectrograph, we obtained spatially resolved spectra for SDSS J09527.62+255257.2, a radio-quiet quasar shown by previous imaging to consist of a galaxy and its close (1.0") companion. We find that the main galaxy is a Type 1 AGN with both broad and narrow AGN emission lines in its spectrum, while the companion galaxy is a Type 2 AGN with narrow emission lines only. The two AGNs are separated by 4.8 kpc, and their redshifts correspond to those of the double peaks of the [O III] emission line seen in the Sloan Digital Sky Survey spectrum. Line diagnostics indicate that both components of the double emission lines are due to AGN photoionization. These results confirm that J0952+2552 contains two spatially separated AGNs. As one of the few confirmed dual AGNs at an intermediate separation of < 10 kpc, this system offers a unique opportunity to study galaxy mergers and their effect on black hole growth.

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preprint available at http://people.ucsc.edu/∼rmcgurk/McGurk_dualagn.pdf

Are luminous radio-loud active galactic nuclei triggered by galaxy interactions?

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We present the results of a comparison between the optical morphologies of a complete sample of 46 southern 2Jy radio galaxies at intermediate redshifts ($0.05 < z < 0.7$) and those of two control samples of quiescent early-type galaxies: 55 ellipticals at redshifts $z \leq 0.01$ from the Observations of Bright Ellipticals at Yale (OBEY) survey, and 107 early-type galaxies at redshifts $0.2 < z < 0.7$ in the Extended Groth Strip (EGS). Based on these comparisons, we discuss the role of galaxy interactions in the triggering of powerful radio galaxies (PRGs). We find that a significant fraction of quiescent ellipticals at low and intermediate redshifts show evidence for disturbed morphologies at relatively high surface brightness levels, which are likely the result of past or on-going galaxy interactions. However, the morphological features detected in the galaxy hosts of the PRGs (e.g. tidal tails, shells, bridges, etc.) are up to 2 magnitudes brighter than those present in their quiescent counterparts. Indeed, if we consider the same surface brightness limits, the fraction of disturbed morphologies is considerably smaller in the quiescent population (53% at $z < 0.2$ and 48% at $0.2 \leq z < 0.7$) than in the PRGs (93% at $z < 0.2$ and 95% at $0.2 \leq z < 0.7$ considering strong-line radio galaxies only). This supports a scenario in which PRGs represent a fleeting active phase of a subset of the elliptical galaxies that have recently undergone mergers/interactions. However, we demonstrate that only a small proportion ($\leq$20%) of disturbed early-type galaxies are capable of hosting powerful radio sources.

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preprint available at http://arxiv.org/abs/1109.0021

CIV Emission and the Ultraviolet through X-ray Spectral Energy Distribution of Radio-Quiet Quasars

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In the restframe ultra-violet (UV), two of the parameters that best characterize the range of emission-line properties in quasar broad emission-line regions are the equivalent width and the blueshift of the CIV $\lambda\,1549$ line relative to the quasar rest frame. We explore the connection between these emission-line properties and the UV through X-ray spectral energy distribution (SED) for radio-quiet (RQ) quasars. Our sample consists of a heterogeneous compilation of 406 quasars from the Sloan Digital Sky Survey (at $z > 1.54$) and Palomar-Green survey (at $z < 0.4$) that have well-measured CIV emission-line and X-ray properties (including 164 objects with measured Γ). We find that RQ quasars with both strong CIV emission and small CIV blueshifts can be classified as "hard-spectrum" sources that are (relatively) strong in the X-ray as compared to the UV. On the other hand, RQ quasars with both weak CIV emission and large CIV blueshifts are instead "soft-spectrum" sources that are (relatively) weak in the X-ray as compared to the UV. This work helps to further bridge optical/soft X-ray "Eigenvector 1" relationships to the UV and hard X-ray. Based on these findings, we argue that future work should consider systematic errors in bolometric corrections (and thus accretion rates) that are derived from a single mean SED. Detailed analysis of the CIV emission line may allow for SED-dependent corrections to these quantities.

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Unification of Luminous Type 1 Quasars through CIV Emission

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Using a sample of ∼30,000 quasars from the 7th Data Release of the Sloan Digital Sky Survey, we explore the range of properties exhibited by high-ionization, broad emission lines, such as CIV λ1549. Specifically we investigate the anti-correlation between continuum luminosity and emission line equivalent width (the Baldwin Effect) and the "blueshifting" of the high-ionization emission lines with respect to low-ionization emission lines. Employing improved redshift determinations from Hewett & Wild, the blueshift of the CIV emission line is found to be nearly ubiquitous, with a mean shift of $\sim 810\,\mathrm{km\,s^{-1}}$ for radio-quiet quasars and $\sim 360\,\mathrm{km\,s^{-1}}$ for radio-loud quasars. The Baldwin Effect is present in both radio-quiet and radio-loud samples. We consider these phenomena within the context of an accretion disk wind model that is modulated by the non-linear correlation between ultraviolet and X-ray continuum luminosity. Composite spectra are constructed as a function of CIV emission line properties in attempt to reveal empirical relationships between different line species and the continuum. Within a two-component disk+wind model of the broad emission line region (BELR), where the wind filters the continuum seen by the disk component, we find that radio-loud quasars are consistent with being dominated by the disk component, while broad absorption line quasars are consistent with being dominated by the wind component. Some radio-quiet objects have emission line features similar to radio-loud quasars; they may simply have insufficient black hole spin to form radio jets. Our results suggest that there could be significant systematic errors in the determination of L_{bol} and black hole mass that make it difficult to place these findings in a more physical context. However, it is possible to classify quasars in a paradigm where the diversity of BELR parameters are due to differences in an accretion disk wind between quasars (and over time); these differences are underlain primarily by the spectral energy distribution, which ultimately must be tied to black hole mass and accretion rate.

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Full paper available at http://iopscience.iop.org/1538-3881/141/5/167/

Chandra X-ray Observations of the redshift 1.53, radio-loud quasar: 3C 270.1.

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Chandra X-ray observations of the high redshift (z=1.532) radio-loud quasar 3C 270.1 in 2008 February show the nucleus to have a power-law spectrum, $\Gamma = 1.66 \pm 0.08$, typical of a radio-loud quasar, and a marginally-detected Fe Kα emission line. The data also reveal extended X-ray emission, about half of which is associated with the radio emission from this source. The southern emission is co-spatial with the radio lobe and peaks at the position of the double radio hotspot. Modeling this hotspot including Spitzer upper limits rules out synchrotron emission from a single power-law population of electrons, favoring inverse-Compton emission with a field of $\sim$11 nT, roughly a third of the equipartition value. The northern emission is concentrated close to the location of a 40deg bend where the radio jet is presumed to encounter external material. It can be explained by inverse Compton emission involving Cosmic Microwave Background photons with a field of $\sim$3 nT, roughly a factor of nine below the equipartition value. The remaining, more diffuse X-ray emission is harder (HR=-0.09 ± 0.22). With only 22.8 ± 5.6 counts, the spectral form cannot be constrained. Assuming thermal emission with a temperature of 4 keV yields an estimate for the luminosity of 1.8×10^{44} erg s^{-1}, consistent with the luminosity-temperature relation of lower-redshift clusters. However deeper Chandra X-ray observations are required to delineate the spatial distribution, and better constrain the spectrum of the diffuse emission to verify that we have detected X-ray emission from a high-redshift cluster.

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The Ultraviolet-to-Mid-Infrared Spectral Energy Distribution of Weak Emission Line Quasars

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We present *Spitzer* Space Telescope photometry of 18 Sloan Digital Sky Survey (SDSS) quasars at $2.7 \leq z \leq 5.9$ which have weak or undetectable high-ionization emission lines in their rest-frame ultraviolet (UV) spectra (hereafter weak-lined quasars, or WLQs). The *Spitzer* data are combined with SDSS spectra and ground-based, near-infrared (IR) photometry of these sources to produce a large inventory of spectral energy distributions (SEDs) of WLQs across the rest-frame $\sim 0.1 - 5$ μm spectral band. The SEDs of our sources are inconsistent with those of BL Lacertae objects which are dominated by synchrotron emission due to a jet aligned close to our line-of-sight, but are consistent with the SED of ordinary quasars with similar luminosities and redshifts that exhibit a near-to-mid-IR 'bump', characteristic of hot dust emission. This indicates that broad emission lines in WLQs are intrinsically weak, rather than suffering continuum dilution from a jet, and that such sources cannot be selected efficiently from traditional photometric surveys.

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The Near-Infrared Coronal Line Spectrum of 54 Nearby Active Galactic Nuclei

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The relationship between emission of coronal lines (CLs) and nuclear activity in 36 Type 1 and 18 Type 2 active active galactic nuclei (AGNs) is analyzed, for the first time, based on near infrared (0.8-2.4 μm) spectra. The eight CLs studied, of Si, S, Fe, Al and Ca elements and corresponding to ionization potentials (IP) in the range 125 – 450 eV, are detected (3σ) in 67% (36 AGNs) of the sample. Our analysis show that the four most frequent coronal lines [Si VI] 1.963μm, [S VIII] 0.9913μm, [S IX] 1.252μm and [Si X] 1.430μm, display a narrow range in luminosity, with most lines located in the interval log$L$ 39 - 40 erg s^{-1}. We found that the non-detection is largely associated with either a lost of spatial resolution or increasing object distance: CLs are essentially nuclear and easily loose contrast in the continuum stellar light for nearby sources or get diluted by the strong AGN continuum as the redshift increases. Yet, there are AGNs where the lack of coronal emission, i.e., lines with IP $\geq$ 100 eV, may be genuine. The absence of these lines reflect a non-standard AGN ionising continuum, namely, a very hard spectrum lacking photons below a few Kev. The analysis of the line profiles points out to a trend of increasing FWHM with increasing IP up to energies around 300 eV, where a maximum in the FWHM is reached. For higher IP lines, the FWHM remains nearly constant or decreases with increasing IP. We ascribe this effect to an increasing density environment as we approach to the innermost regions of these AGNs, where densities above the critical density of the CLs with IP larger than 300 eV are reached. This sets a strict range limit for the density in the boundary region between the narrow and the broad region of $10^8 - 10^9$ cm^{-3}. A relationship between the luminosity of the coronal lines and that of the soft and hard X-ray emission and the soft X-ray photon index is observed: the coronal emission becomes stronger with both increasing x-ray emission (soft and hard) and steeper X-ray photon index, i.e. softer X-ray spectra. Thus, photoionization appears as the dominant excitation mechanism. These trends hold when considering Type 1 sources only; they get weaker or vanish when including Type 2 sources, very likely because the X-ray emission measured in the later is not the intrinsic ionising continuum.

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Mass of the Southern Black Hole in NGC 6240 from Laser Guide Star Adaptive Optics

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NGC 6240 is a pair of colliding disk galaxies, each with a black hole in its core. We have used laser guide star adaptive optics on the Keck II telescope to obtain high-resolution ($\sim$ 0.06”) near-infrared integral-field spectra of the region surrounding the supermassive black hole in the south nucleus of this galaxy merger. We use the K-band CO absorption bandheads to trace stellar kinematics. We obtain a spatial resolution of about 20 pc and thus directly resolve the sphere of gravitational influence of the massive black hole. We explore two different methods to measure the black hole mass. Using a Jeans Axisymmetric Multi-Gaussian mass model, we investigate the limit that a relaxed mass distribution produces all of the measured velocity dispersion, and find an upper limit on the black hole mass at $2.0 \pm 0.2 \times 10^9 M_\odot$. When assuming the young stars whose spectra we observe remain in a thin disk, we compare Keplerian velocity fields to the measured two-dimensional velocity field measured and fit for a mass profile containing a black hole point mass plus a radially-varying spherical component, which suggests a lower limit for the black hole mass of $8.7 \pm 0.3 \times 10^8 M_\odot$. Our measurements of the stellar velocity dispersion place this AGN within the scatter of the M_{BH}-σ_* relation. As NGC 6240 is a merging system, this may indicate that the relation is preserved during a merger at least until the final coalescence of the two nuclei.

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A New Cosmological Distance Measure Using AGN

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Accurate distances to celestial objects are key to establishing the age and energy density of the Universe and the nature of dark energy. A distance measure using active galactic nuclei (AGN) has been sought for more than forty years, as they are extremely luminous and can be observed at very large distances. We report here the discovery of an accurate luminosity distance measure using AGN. We use the tight relationship between the luminosity of an AGN and the radius of its broad line region established via reverberation mapping to determine the luminosity distances to a sample of 38 AGN. All reliable distance measures up to now have been limited to moderate redshift — AGN will, for the first time, allow distances to be estimated to $z \sim 4$, where variations of dark energy and alternate gravity theories can be probed.

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