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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

Variability Selected Low-Luminosity Active Galactic Nuclei in the 4 Ms Chandra Deep Field-South

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The 4 Ms *Chandra* Deep Field-South (CDF-S) and other deep X-ray surveys have been highly effective at selecting active galactic nuclei (AGN). However, cosmologically distant low-luminosity AGN (LLAGN) have remained a challenge to identify due to significant contribution from the host galaxy. We identify long-term X-ray variability (∼month–years, observed frame) in 20 of 92 CDF-S galaxies spanning redshifts $z \approx 0.08 - 1.02$ that do not meet other AGN selection criteria. We show that the observed variability cannot be explained by X-ray binary populations or ultraluminous X-ray sources, so the variability is most likely caused by accretion onto a supermassive black hole. The variable galaxies are not heavily obscured in general,

with a stacked effective power-law photon index of $\Gamma_{\rm stack} \approx 1.93 \pm 0.13$, and are therefore likely LLAGN. The LLAGN tend to lie a factor of ≈6–80 below the extrapolated linear variability-luminosity relation measured for luminous AGN. This may be explained by their lower accretion rates. Variability-independent black-hole mass and accretion-rate estimates for variable galaxies show that they sample a significantly different black-hole mass-accretion rate space, with masses a factor of 2.4 lower and accretion rates a factor of 22.5 lower than variable luminous AGN at the same redshift. We find that an empirical model based on a universal broken power-law PSD function, where the break frequency depends on SMBH mass and accretion rate, roughly reproduces the shape, but not the normalization, of the variability-luminosity trends measured for variable galaxies and more luminous AGN.

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Rotating Disks and Non-Kinematic Double Peaks

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Double-peaked line profiles are commonly considered a hallmark of rotating disks, with the distance between the peaks a measure of the rotation velocity. However, double-peaks can arise also from radiative transfer effects in optically thick non-rotating sources. Utilizing exact solutions of the line transfer problem we present a detailed study of line emission from geometrically thin Keplerian disks. We derive the conditions for emergence of kinematic double peaks in optically thin and thick disks, and find that it is generally impossible to disentangle the effects of kinematics and line opacity in observed double-peaked profiles. Unless supplemented by additional information, a double-peaked profile alone is not a reliable indicator of a rotating disk. In certain circumstances, triple and quadruple profiles might be better indicators of rotation in optically thick disks.

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preprint available at http://adsabs.harvard.edu/abs/2012arXiv1202.1450E

On the Unification of Active Galactic Nuclei

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The inevitable spread in properties of the toroidal obscuration of active galactic nuclei (AGNs) invalidates the widespread notion that type 1 and 2 AGNs are intrinsically the same objects. Instead, AGNs are drawn *preferentially* from the distribution of torus covering factors; type 2 are more likely drawn from the distribution higher end, type 1 from its lower end. Type 2 AGNs have a higher IR luminosity, lower narrow-line luminosity and a higher fraction of Compton thick X-ray obscuration than type 1. Meaningful studies of unification statistics cannot be conducted without first determining the intrinsic distribution function of torus covering factors.

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Recoiling black holes: electromagnetic signatures, candidates, and astrophysical implications

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Supermassive black holes (SMBHs) may not always reside right at the centers of their host galaxies. This is a prediction of numerical relativity simulations, which imply that the newly formed single SMBH, after binary coalescence in a galaxy merger, can receive kick velocities up to several 1000 km/s due to anisotropic emission of gravitational waves. Long-lived oscillations of the SMBHs in galaxy cores, and in rare cases even SMBH ejections from their host galaxies, are the consequence. Observationally, accreting recoiling SMBHs would appear as quasars spatially and/or kinematically off-set from their host galaxies. The presence of the "kicks" has a wide range of astrophysical implications which only now are beginning to be explored, including consequences for black hole and galaxy assembly at the epoch of structure formation, black hole feeding, and unified models of Active Galactic Nuclei (AGN). Here, we review the observational signatures of recoiling SMBHs and the properties of the first candidates which have emerged, including follow-up studies of the candidate recoiling SMBH of SDSSJ092712.65+294344.0.

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paper available at http://www.hindawi.com/journals/aa/2012/364973/ and http://xxx.lanl.gov/abs/1202.1977

Tidal Disruption of Stars by Supermassive Black Holes

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NAOC

Tidal disruption and subsequent accretion of a star by a supermassive black hole (SMBH) produces a luminous flare of radiation, lasting on the order of months to years. The first tidal flares of giant amplitude have been detected in X-rays in the *ROSAT* all-sky survey, matching all key predictions from tidal disruption theory including a $t^{-5/3}$ decline law, giant peak luminosities and ultrasoft X-ray spectra. More recently, similar flares appeared in the UV, optical, and radio band. This contribution is focussed on optical emission-line "echoes" from tidal flares.

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Correlation analysis of a large sample of narrow-line Seyfert 1 galaxies: linking central engine and host properties

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We present a statistical study of a large, homogeneously analyzed sample of narrow-line Seyfert 1 (NLS1) galaxies, accompanied by a comparison sample of broad-line Seyfert 1 (BLS1) galaxies. Optical emission-line and continuum properties are subjected to correlation analyses, in order to identify the main drivers of the correlation space of active galactic nuclei (AGN), and of NLS1 galaxies in particular. For the first time, we have established the density of the narrow-line region as a key parameter in Eigenvector 1 space, as important as the Eddington ratio L/L_{Edd}. This is important because it links the properties of the central engine with the properties of the host galaxy; i.e., the interstellar medium (ISM). We also confirm previously found correlations involving the line width of Hβ, and the strength of the Fe II and [O III] λ5007 emission lines, and we confirm the important role played by L/L_{Edd} in driving the properties of NLS1 galaxies. A spatial correlation analysis shows that large-scale environments of the BLS1 and NLS1 galaxies of our sample are similar. If mergers are rare in our sample, accretion-driven winds on the one hand, or bar-driven inflows on the other hand, may account for the strong dependence of Eigenvector 1 on ISM density.

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Ionized outflows in SDSS type 2 quasars at z∼0.3-0.6

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We have analyzed the spatially integrated kinematic properties of the ionized gas within the inner $r \leq$few kpc in 13 optically selected SDSS type 2 quasars at $z \sim$0.3-0.6, using the [OIII]$\lambda\lambda$4959,5007 lines. The line profiles show a significant asymmetry in 11 objects. There is a clear preference for blue asymmetries, which are found in 9/13 quasars at 10% intensity level. In coherence with studies on other types of active and non active galaxies, we propose that the asymmetries are produced by outflows where differential dust extinction is at work.

This scenario is favoured by other results we find: in addition to quiescent ambient gas, whose kinematic properties are consistent with gravitational motions, we have discovered highly perturbed gas in all objects. This gas emits very broad lines ($R = \frac{FWHM[OIII]}{FWHM_{stars}} \geq$2). While the quiescent gas shows small or null velocity shifts relative to the systemic velocity, the highly perturbed gas trends to show larger shifts which, moreover, are blueshifts in general. Within a given object, the most perturbed gas trends to have the largest blueshift as well. All together support that the perturbed gas, which is responsible for the blue asymmetries of the line profiles, is outflowing. The outflowing gas is located within the quasar ionization cones, in the narrow line region.

The relative contribution of the outflowing gas to the total [OIII] line flux varies from object to object in the range ∼10-70%. An anticorrelation is found such that, the more perturbed the outflowing gas is, the lower its relative contribution is to the total [OIII] flux . This suggests that outflows with more perturbed kinematics involve a smaller fraction of the total mass of ionized gas.

Although some bias affects the sample, we argue that ionized gas outflows are a common phenomenon in optically selected type 2 quasars at $0.3 \leq z \leq 0.6$.

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A multiwavelength view of the flaring state of PKS 2155-304 in 2006

HESS Collaboration

Context: Multiwavelength (MWL) observations of the blazar PKS 2155-304 during two weeks in July and August 2006, the period when two exceptional flares at very high energies (VHE, E>∼100 GeV) occurred, provide a detailed picture of the evolution of its emission. The complete data set from this campaign is presented, including observations in VHE γ-rays (H.E.S.S.), X-rays (*RXTE*, *CHANDRA*, *SWIFT* XRT), optical (*SWIFT* UVOT, Bronberg, Watcher, ROTSE), and in the radio band (NRT, HartRAO, ATCA). Optical and radio light curves from 2004 to 2008 are compared to the available VHE data from

this period, to put the 2006 campaign into the context of the long-term evolution of the source.
Aims: The data set offers a close view of the evolution of the source on different time scales and yields new insights into the properties of the emission process. The predictions of synchrotron self-Compton (SSC) scenarios are compared to the MWL data, with the aim of describing the dominant features in the data down to the hour time scale.
Methods: The spectral variability in the X-ray and VHE bands is explored and correlations between the integral fluxes at different wavelengths are evaluated. SSC modelling is used to interpret the general trends of the varying spectral energy distribution.
Results: The X-ray and VHE γ-ray emission are correlated during the observed high state of the source, but show no direct connection with longer wavelengths. The long-term flux evolution in the optical and radio bands is found to be correlated and shows that the source reaches a high state at long wavelengths after the occurrence of the VHE flares. Spectral hardening is seen in the *SWIFT* XRT data.
Conclusions: The nightly averaged high-energy spectra of the non-flaring nights can be reproduced by a stationary one-zone SSC model, with only small variations in the parameters. The spectral and flux evolution in the high-energy band during the night of the second VHE flare is modelled with multi-zone SSC models, which can provide relatively simple interpretations for the hour time-scale evolution of the high-energy emission, even for such a complex data set. For the first time in this type of source, a clear indication is found for a relation between high activity at high energies and a long-term increase in the low frequency fluxes.

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The Cosmic History of Hot Gas Cooling and Radio AGN Activity in Massive Early-Type Galaxies

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We study the X-ray properties of 393 optically selected early-type galaxies (ETGs) over the redshift range of $z \approx 0.0$–1.2 in the *Chandra* Deep Fields. To measure the average X-ray properties of the ETG population, we use X-ray stacking analyses with a subset of 158 passive ETGs (148 of which were individually undetected in X-ray). This ETG subset was constructed to span the redshift ranges of $z = 0.1$–1.2 in the ≈4 Ms CDF-S and ≈2 Ms CDF-N and $z = 0.1$–0.6 in the ≈250 ks E-CDF-S where the contribution from individually undetected AGNs is expected to be negligible in our stacking. We find that 55 of the ETGs are detected individually in the X-rays, and 12 of these galaxies have properties consistent with being passive hot-gas dominated systems (i.e., systems not dominated by an X-ray bright Active Galactic Nucleus; AGN). On the basis of our analyses, we find little evolution in the mean 0.5–2 keV to B-band luminosity ratio ($L_{\rm X}/L_B \propto [1+z]^{1.2}$) since $z \approx 1.2$, implying that some heating mechanism prevents the gas from cooling in these systems. We consider that feedback from radio-mode AGN activity could be responsible for heating the gas. We select radio AGNs in the ETG population using their far-infrared/radio flux ratio. Our radio observations allow us to constrain the duty cycle history of radio AGN activity in our ETG sample. We estimate that if scaling relations between radio and mechanical power hold out to $z \approx 1.2$ for the ETG population being studied here, the average mechanical power from AGN activity is a factor of ≈1.4–2.6 times larger than the average radiative cooling power from hot gas over the redshift range $z \approx 0$–1.2. The excess of inferred AGN mechanical power from these ETGs is consistent with that found in the local Universe for similar types of galaxies.

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Study of LINER sources with broad Hα emission. Spectral energy distribution and multiwavelength correlations

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Context. The geometry and physical properties of the accretion mode, and the radiative processes occurring in AGN-powered low ionization nuclear emission-line regions (LINERs) remain a riddle. Both a standard thin accretion disk and an inner-hot radiatively-inefficient accretion flow (RIAF) have been invoked. Models depending on only a jet have also been invoked to explain the broad-band spectral energy distribution (SED) of LINERs.
Aims. We attempt to infer the accretion mechanism and radiative processes giving rise to the SEDs of a well-defined optically-selected sample of LINERs showing a definite detection of broad Hα emission (LINER 1s).
Methods. We construct SEDs for six LINER 1s with *simultaneous UV and X-ray fluxes*, and we looked for multiwavelength, radio to X-ray and UV to X-ray, correlations.
Results. At a given X-ray luminosity, the average SED of the six LINER 1s in our sample: (1) resembles the SED of radio-loud quasars in the radio band, $<\log\ R_{\rm X}>\approx -2.7$, (2) exhibits a weak UV bump, $<\alpha_{\rm ox}>\approx -1.17\pm0.02$ with a dispersion $\sigma=0.01$, and (3) displays a X-ray spectrum similar to radio-quiet quasars. The bolometric luminosities inferred from the SEDs of these LINER 1s are extremely faint, at least two orders of magnitude lower than AGN. The X-ray bolometric correction, $\kappa_{2-10\ \rm keV}$, of our sample is lower than in the case of AGN, with a mean value of 16. We find a strong anticorrelation between the radio loudness parameter, $R_{\rm X}$, and the Eddington ratio for our sample, confirming previous results. Moreover, we find a positive correlation between the radio luminosity and the X-ray luminosity which places AGN-powered LINERs, on a radio-power scale, right between low luminosity Seyferts and low luminosity radio galaxies. We complement our $\alpha_{\rm ox}$ list with values derived on a well defined sample of UV-variable LINERs, and establish a strong positive correlation between α_{ox} (considering negative values) and the Eddington ratio, in contrast to the correlation found for luminous AGN. Lastly, we tested two different fundamental planes existing in the literature on our sample, in an attempt to put constraints on the debated origin of the X-ray emission, "RIAF versus jet". The results came contradictory with one pointing toward a RIAF-dominated X-ray emission process and the other pointing toward a jet domination.

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Sweeping Away the Mysteries of Dusty Continuous Winds in AGN

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An integral part of the Unified Model for Active Galactic Nuclei (AGNs) is an axisymmetric obscuring medium, which is commonly depicted as a torus of gas and dust surrounding the central engine. However, a robust, dynamical model of the torus is required in order to understand the fundamental physics of AGNs and interpret their observational signatures. Here we explore self-similar, dusty disk-winds, driven by both magnetocentrifugal forces and radiation pressure, as an explanation for the torus. Using these models, we make predictions of AGN infrared (IR) spectral energy distributions (SEDs) from $2-100\mu$m by varying parameters such as: the viewing angle (from $i=0^\circ-90^\circ$); the base column density of the wind (from $N_{H,0}=10^{23}-10^{25}$ cm^{-2}); the Eddington ratio (from $L/L_{Edd}=0.01-0.1$); the black hole mass (from $M_{BH}=10^8-10^9$ M$_\odot$); and the amount of power in the input spectrum emitted in the X-ray relative to that emitted in the UV/optical (from $\alpha_{ox}=1.1-2.1$). We find that models with $N_{H,0}=10^{25}$ cm^{-2}, $L/L_{Edd}=0.1$, and $M_{BH}\geq 10^8$M$_\odot$ are able to adequately approximate the general shape and amount of power expected in the IR as observed in a composite of optically luminous Sloan Digital Sky Survey (SDSS) quasars. The effect of varying the relative power coming out in X-rays relative to the UV is a change in the emission below $\sim 5\ \mu$m from the hottest dust grains; this arises from the differing contributions to heating and acceleration of UV and X-ray photons. We see mass outflows ranging from $\sim$ 1–4 M$_\odot$ yr^{-1}, terminal velocities ranging from $\sim$ 1900–8000 km sec^{-1}, and kinetic luminosities ranging from $\sim 1\times10^{42}$–8×10^{43} erg s^{-1}. Further development of this model holds promise for using

specific features of observed IR spectra in AGNs to infer fundamental physical parameters of the systems.

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The Relationship Between Black Hole Growth and Star Formation in Seyfert Galaxies

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We present estimates of black hole accretion rates and nuclear, extended, and total star-formation rates for a complete sample of Seyfert galaxies. Using data from the Spitzer Space Telescope, we measure the active galactic nucleus (AGN) luminosity using the [O IV] λ25.89 μm emission line and the star-forming luminosity using the 11.3 μm aromatic feature and extended 24 μm continuum emission. We find that black hole growth is strongly correlated with nuclear ($r < 1$ kpc) star formation, but only weakly correlated with extended ($r > 1$ kpc) star formation in the host galaxy. In particular, the nuclear star-formation rate (SFR) traced by the 11.3 μm aromatic feature follows a relationship with the black hole accretion rate (BHAR) of the form $SFR \propto \dot{M}_{BH}^{0.8}$, with an observed scatter of 0.5 dex. This SFR–BHAR relationship persists when additional star formation in physically matched $r = 1$ kpc apertures is included, taking the form $SFR \propto \dot{M}_{BH}^{0.6}$. However, the relationship becomes almost indiscernible when total SFRs are considered. This suggests a physical connection between the gas on sub-kpc and sub-pc scales in local Seyfert galaxies that is not related to external processes in the host galaxy. It also suggests that the observed scaling between star formation and black hole growth for samples of AGNs will depend on whether the star formation is dominated by a nuclear or extended component. We estimate the integrated black hole and bulge growth that occurs in these galaxies and find that an AGN duty cycle of 5%–10% would maintain the ratio between black hole and bulge masses seen in the local universe.

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Discovery of Polarization Reverberation in NGC 4151

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Observations of the optical polarization of NGC 4151 in 1997–2003 show variations of an order of magnitude in the polarized flux while the polarization position angle remains constant. The amplitude of variability of the polarized flux is comparable to the amplitude of variability of the total U-band flux, except that the polarized flux follows the total flux with a lag of 8 ± 3 days. The time lag and the constancy of the position angle strongly favor a scattering origin for the variable polarization rather than a non-thermal synchrotron origin. The orientation of the position angle of the polarized flux (parallel to the radio axis) and the size of the lag imply that the polarization arises from electron scattering in a flattened region within the low-ionization component of the broad-line-region. Polarization from dust scattering in the equatorial torus is ruled out as the source of the lag in polarized flux because it would produce a larger lag and, unless the half-opening angle of the torus is $>53^o$, the polarization would be perpendicular to the radio axis. We note a long-term change in the percentage of polarization at similar total flux levels and this could be due either to changing non-axisymmetry in the optical continuum emission, or a change in the number of scatterers on a timescale of years.

ApJ in press

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Preprint available at http://adsabs.harvard.edu/abs/2007arXiv0711.1019G

Special Announcements

A Database of Extragalactic IR/Optical/UV Jets

The Astrophysics Group at the Florida Institute of Technology is pleased to announce a new, web-accessible database of IR/Optical/UV Jets is available to the community. This database, which can be found at http://astro.fit.edu/jets, features an updated list of radio jets that emit in one or more of the infrared, optical and ultraviolet bands. It also features links to reduced HST data we are making available to download. Future updates will include links to ADS, XJET and other databases, as well as other information. This database is being provided partly as a service to the community but also as part of a planned project to do the first statistical study of the optical jet population. For further information please contact Eric Perlman.

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