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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 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

Modeling optical and UV polarization of AGNs II : Polarization imaging and complex reprocessing

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Context : The innermost parts of active galactic nuclei (AGNs) are believed to be comprised of several emission and scattering media coupled by radiative processes. These regions generally cannot be spatially resolved. Spectropolarimetric observations give important information about the reprocessing geometry.
Aims : We aim to obtain a coherent model of the polarization signature resulting from the radiative coupling between the components, to compare our results with polarimetry of thermal AGNs and thereby to put constraints on the geometry.
Methods : We use a new public version of STOKES, a Monte Carlo radiative transfer code presented in the first paper of this series. The code has been significantly improved for computational speed and polarization imaging has been implemented. The imaging capability helps to improve understanding of the contributions of different components to the spatially-integrated flux. We couple continuum sources with a variety of reprocessing regions such as equatorial scattering regions, polar outflows, and toroidal obscuring dust and we study the resulting polarization. We explore combinations and compute a grid of thermal AGN models for different half-opening angles of the torus and polar winds. We also consider a range of optical depths for equatorial and polar electron scattering and investigate how the model geometry influences the type-1/type-2 polarization dichotomy for thermal AGNs (type-1 AGNs tending to have polarization parallel to the axis of the torus and type-2 AGNs tending to have polarization perpendicular to it).
Results : We put new constrains on the inflowing medium within the inner walls of the torus. To reproduce the observed

polarization in type-1 objects, the inflow should be confined to the common equatorial plane of the torus and the accretion disc and have a radial optical depth of $1 < \tau < 3$. Our modeling of type-1 AGNs indicates that the torus is more likely to have a large ($\sim 60^\circ$) half-opening angle. Polarization perpendicular to the axis of the torus may arise at a type-1 viewing angle for a torus half-opening angle of 30° – 45° or polar outflows with an optical depth near unity. Our modeling suggests that most Seyfert-2 AGN must have a half-opening angle $> 60^\circ$ to match the level of perpendicular polarization expected. If outflows are collimated by the torus inner walls, they must not be optically thick ($\tau < 1$) in order to preserve the polarization dichotomy. The wind's optical depth is found not to play a critical role for the degree of polarization of type-2 thermal AGNs but it has a significant impact on the type-1/type-2 polarization dichotomy when the optical depth exceeds $\tau = 0.3$.

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The AMIGA sample of isolated galaxies. XI. Optical characterisation of nuclear activity

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CONTEXT. This paper is part of a series involving the AMIGA project (Analysis of the Interstellar Medium of Isolated GAlaxies), which identifies and studies a statistically significant sample of the most isolated galaxies in the northern sky.
AIM. We present a catalogue of nuclear activity, traced by opticalemission lines, in a well-defined sample of themost isolated galaxies in the local Universe, which will be used as a basis for studying the effect of the environmenton nuclear activity.
METHODS. We obtained spectral data from the 6th Data Release of theSloan Digital Sky Survey, which were inspected in a semi-automatic way. Wesubtracted the underlying stellar populations from the spectra (usingthe software Starlight) and modelled the nuclear emission features. Standardemission-linediagnosticsdiagrams were applied, using a new classification scheme that takes into accountcensored data, to classify the type of nuclear emission.
RESULTS. We provide a final catalogue of spectroscopic data, stellar populations,emission lines and classification of optical nuclear activity for AMIGAgalaxies. The prevalence of optical active galactic nuclei (AGN) in AMIGAgalaxies is 20.4%, or 36.7% includingtransition objects. The fraction of AGN increases steeply towards earliermorphological types and higher luminosities. We compare these resultswith amatched analysis of galaxies in isolated denser environments (Hickson Compact Groups). After correcting for theeffects of the morphology and luminosity, we find that there is no evidence fora difference inthe prevalence of AGN between isolated and compact group galaxies, and wediscuss the implications of this result.
CONCLUSIONS. We find that a major interaction is not a necessary condition for the triggering of optical AGN.

Astronomy & Astrophysics

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A survey for the missing hydrogen in high redshift radio sources

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Unlike at lower redshift, where there is a 40% detection rate, surveys for 21-cm absorption arising within the hosts of $z \gtrsim 1$ radio galaxies and quasars have been remarkably unsuccessful. Curran et al. (2008) suggest that this is due to the high redshift selection biasing towards the most optically bright objects (those most luminous in the ultra-violet in the rest-frame), where the gas is ionised by the active galactic nucleus. They therefore argue that there must be a population of fainter objects in which the hydrogen is not ionised and which exhibit a similar detection rate as at lower redshifts. In order to find this "missing" gas at high redshift, we have therefore undertaken a survey of $z \gtrsim 2$ radio sources, selected by optical faintness. Despite having optical magnitudes which indicate that the targets have ultra-violet luminosities below the threshold where all of the gas is

ionised, there were no detections in any of the eight sources for which useable data were obtained. Upon an analysis of the spectral energy distributions, ionising photon rates can only be determined for three of these, all of which suggest that the objects are *above* the highest luminosity of a current 21-cm detection. The possibility that the other five could be located at lower photon rates cannot be ruled out, although zero detections out of five is not statistically significant. Another possible cause of the non-detections is that our selection biases the sample towards sources which are very steep in the radio band, with a mean spectral index of $\langle\alpha\rangle = -1.0$, cf. -0.3 for both the 21-cm detections and UV luminous non-detections. This adds the further possibility that the sources have very extended emission, which would have the effect of reducing the coverage by the putative absorbing gas, thus decreasing the sensitivity of the observation.

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The X-ray Star Formation Story as Told by Lyman Break Galaxies in the 4 Ms CDF-S

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We present results from deep X-ray stacking of >4000 high redshift galaxies from $z \approx 1$ to 8 using the 4 Ms Chandra Deep Field South (CDF-S) data, the deepest X-ray survey of the extragalactic sky to date. The galaxy samples were selected using the Lyman break technique based primarily on recent *H*ST ACS and WFC3 observations. Based on such high specific star formation rates (sSFRs): log SFR$/M_* > -8.7$, we expect that the observed properties of these LBGs are dominated by young stellar populations. The X-ray emission in LBGs, eliminating individually detected X-ray sources (potential AGN), is expected to be powered by X-ray binaries and hot gas. We find, for the first time, evidence of evolution in the X-ray/SFR relation. Based on X-ray stacking analyses for $z < 4$ LBGs (covering $\sim 90\%$ of the Universe's history), we find that the 2–10 keV X-ray luminosity evolves weakly with redshift (z) and SFR as: $\log \mathrm{L_X} = 0.93 \log(1+z) + 0.65 \log \mathrm{SFR} + 39.80$. By comparing our observations with sophisticated X-ray binary population synthesis models, we interpret that the redshift evolution of $\mathrm{L_X}$/SFR is driven by metallicity evolution in HMXBs, likely the dominant population in these high sSFR galaxies. We also compare these models with our observations of X-ray luminosity density (total 2–10 keV luminosity per Mpc^3) and find excellent agreement. While there are no significant stacked detections at $z > 5$, we use our upper limits from $5 < z < 8$ LBGs to constrain the SMBH accretion history of the Universe around the epoch of reionization.

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Discovery of a Flat-Spectrum Radio Nucleus in NGC 3115

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The early-type galaxy NGC 3115, at a distance of 10.2 Mpc, hosts the nearest billion-solar-mass black hole. Wong et al. recently inferred a substantial Bondi accretion rate near the black hole. Bondi-like accretion is thought to fuel outflows, which can be traced through their radio emission. This paper reports the discovery of a radio nucleus in NGC 3115, with a diameter less than 0.17 arcsec (8.4 pc), a luminosity at 8.5 GHz of 3.1×10^{35} erg s^{-1}, and a flat spectrum ($\alpha = -0.23 \pm 0.20, S \propto \nu^{\alpha}$). The radio source coincides with the galaxy's photocenter and candidate X-ray nucleus. The emission is radio-loud, suggesting the presence of an outflow on scales less than 10 pc. On such scales, the Bondi accretion could be impeded by heating due to disruption of the outflow.

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A massive bubble of extremely metal poor gas around a collapsing Lyα blob at z=2.54

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Using long-slit optical spectroscopy obtained at the 10.4 m Gran Telescopio Canarias, we have examined the gaseous environment of the radio-loud quasar TXS 1436+157 (z=2.54), previously known to be associated with a large Lyα nebula and a spatially extended Lyα-absorbing structure. From the Lyα nebula we measure kinematic properties consistent with infall at a rate of $\sim$10-100 $M_{\odot}$ yr^{-1} – more than sufficient to power a quasar at the top of the luminosity function. The absorbing structure lies outside of the Lyα nebula, at a radius of $\gtrsim$40 kpc from the quasar. Against the bright unresolved continuum and line emission from the quasar, we detect in absorption the NV $\lambda\lambda$1239,1241, CIV$\lambda\lambda$1548,1551 and SiIV $\lambda\lambda$1394,1403 doublets, with no unambiguous detection of absorption lines from any low-ionization species of metal. The metal column densities, taken together with the HI column density measurement from the literature, indicate that the absorbing gas is predominantly ionized by the quasar, has a mass of hydrogen of $\gtrsim 1.6 \times 10^{11}$ M$_{\odot}$, a gas density of $\leq$18 cm^{-3}, a line of sight thickness of $\geq$18 pc, and a covering factor approaching unity. While this absorbing structure is clearly not composed of pristine gas, it has an extremely low metallicity, with ionization models providing a 3σ limit of 12+log(O/H)$\leq$7.3. To explain these results, we discuss a scenario involving starburst-driven superbubbles and the creation of infalling filaments of cold gas which fuel/trigger the quasar. We also discuss the possibility of detecting large-scale absorbers such as this in emission when illuminated by a powerful quasar.

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Suzaku reveals X–ray continuum piercing the nuclear absorber in Markarian 231

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We report the results from a 2011 *Suzaku* observation of the nearby low-ionization BAL quasar/ULIRG Markarian 231. These data reveal that the X-ray spectrum has undergone a large variation from the 2001 *XMM-Newton* and *BeppoSAX* observations. We interpret this finding according to a scenario whereby the X-ray continuum source is obscured by a two-component partial-covering absorber with $N_H \sim 10^{22}$ and $\sim 10^{24}$ cm^{-2}, respectively. The observed spectral change is mostly explained by a progressive appearance of the primary continuum at < 10 keV due to the decrease of the covering fraction of the denser absorption component. The properties of the X-ray obscuration in Mrk 231 match well with those of the X-ray shielding gas predicted by the theoretical models for an efficient radiatively-driven acceleration of the BAL wind. In particular, the X-ray absorber might be located at the extreme base of the outflow. We measure a 2-10 keV luminosity of $L_{2-10} = 3.3 \times 10^{43}$ erg s^{-1} for the 2011 data set, i.e. an increase of 30% with respect to the 2001 value.

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Multiwavelength campaign on Mrk 509
XII. Broad band spectral analysis.

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The origin of the different spectral components present in the high-energy (UV to X-rays/gamma-rays) spectra of Seyfert galaxies is still being debated a lot. One of the major limitations, in this respect, is the lack of really simultaneous broad-band observations that allow us to disentangle the behavior of each component and to better constrain their interconnections. The simultaneous UV to X-rays/gamma rays data obtained during the multiwavelength campaign on the bright Seyfert 1 Mrk 509 are used in this paper and tested against physically motivated broad band models.

Mrk 509 was observed by XMM-Newton and INTEGRAL in October/November 2009, with one observation every four days for a total of ten observations. Each observation has been fitted with a realistic thermal Comptonization model for the continuum emission. Prompted by the correlation between the UV and soft X-ray flux, we used a thermal Comptonization component for the soft X-ray excess. We also included a warm absorber and a reflection component, as required by the precise studies previously done by our consortium. The UV to X-ray/gamma-ray emission of Mrk 509 can be well fitted by these components. The presence of a relatively hard high-energy spectrum points to the existence of a hot ($kT \sim 100$ keV), optically-thin ($\tau \sim 0.5$) corona producing the primary continuum. In contrast, the soft X-ray component requires a warm ($kT \sim 1$ keV), optically-thick ($\tau \sim$ 10-20) plasma.

Estimates of the amplification ratio for this warm plasma support a configuration relatively close to the "theoretical" configuration of a slab corona above a passive disk. An interesting consequence is the weak luminosity-dependence of its emission, which is a possible explanation of the roughly constant spectral shape of the soft X-ray excess seen in AGNs. The temperature (~ 3 eV) and flux of the soft-photon field entering and cooling the warm plasma suggests that it covers the accretion disk down

to a transition radius R_{tr} of 10-20 R_g. This plasma could be the warm upper layer of the accretion disk.

In contrast, the hot corona has a more photon-starved geometry. The high temperature ($\sim$ 100 eV) of the soft-photon field entering and cooling it favors a localization of the hot corona in the inner flow. This soft-photon field could be part of the comptonized emission produced by the warm plasma. In this framework, the change in the geometry (i.e. R_{tr}) could explain most of the observed flux and spectral variability.

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No clear submillimetre signature of suppressed star formation amongst X-ray luminous AGNs

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Many theoretical models require powerful active galactic nuclei (AGNs) to suppress star formation in distant galaxies and reproduce the observed properties of today's massive galaxies. A recent study based on *Herschel*-SPIRE submillimetre observations claimed to provide direct support for this picture, reporting a significant decrease in the mean star-formation rates (SFRs) of the most luminous AGNs ($L_X > 10^{44}$ ergs) at $z \approx$1-3 in the *Chandra* Deep Field-North (CDF-N). In this letter we extend these results using *Herschel*-SPIRE 250 μm data in the COSMOS and CDF-S fields to achieve an order of magnitude improvement in the number of sources at $L_X > 10^{44}$ ergs. On the basis of our analysis, we find no strong evidence for suppressed star formation in $L_X > 10^{44}$ ergs AGNs at $z \approx$1-3. The mean SFRs of the AGNs are constant over the broad X-ray luminosity range of $L_X \approx 10^{43} - 10^{45}$ ergs (with mean SFRs consistent with typical star-forming galaxies at $z \approx$2; $< SFRs >\approx$100-200 $M_\odot$ yr^{-1}). We suggest that the previous CDF-N results were likely due to low number statistics. We discuss our results in the context of current theoretical models.

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Quasar host galaxies at $z = 1 - 2$

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We present deep *HST/WFPC2*, rest-frame U images of 17 $\sim L^\star$ quasars at $z \approx 1$ and $z \approx 2$ (V and I bands respectively), designed to explore the host galaxies. We fit the images with simple axisymmetric galaxy models, including a point-source, in order to separate nuclear and host-galaxy emission. We successfully model all of the host galaxies, with luminosities stable to within 0.3 mag. Combining with our earlier *NICMOS* rest-frame optical study of the same sample, we provide the first rest-frame $U - V$ colours for a sample of quasar host galaxies. While the optical luminosities of their host galaxies indicate that they are drawn purely from the most massive ($\gtrsim L^\star$) early-type galaxy population, their colours are systematically bluer than those of comparably massive galaxies at the same redshift. The host galaxies of the radio-loud quasars (RLQ) in our sample are more luminous than their radio-quiet quasar (RQQ) counterparts at each epoch, but have indistinguishable colours, confirming that the RLQ's are drawn from only the most massive galaxies ($10^{11} - 10^{12}$ M$_\odot$ even at $z \approx 2$), while the RQQ's are slightly less massive ($\sim 10^{11}$ M$_\odot$). This is consistent with the well-known anti-correlation between radio-loudness and accretion rate. Using simple stellar population "frosting" models we estimate mean star formation rates of ~ 350 M$_\odot$ yr^{-1} for the RLQ's and ~ 100 M$_\odot$ yr^{-1} for the RQQ's at $z \approx 2$. By $z \approx 1$, these rates have fallen to ~ 150 M$_\odot$ yr^{-1} for the RLQ's and ~ 50 M$_\odot$ yr^{-1} for the RQQ's. We conclude that while the host galaxies are extremely massive, they remain actively star-forming at, or close to, the epoch of the quasar.

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The environment of AGNs and the activity degree of their surrounding galaxies

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Aims. We present results of a comprehensive spectral study on the large-scale environment of AGNs based on Sloan Spectroscopic Survey data. Methods. We analyzed the spectra of galaxies in the environment of AGN and other activity classes up to distances of 1 Mpc. Results. The mean Hα and [OIII] λ5007 line luminosities in the environmental galaxies within a projected radius of 1 Mpc are highest around Seyfert 1 galaxies, with decreasing luminosities for Seyfert 2 and HII galaxies, and lowest for absorption line galaxies. Furthermore, there is a trend toward Hα and [OIII] luminosities in the environmental galaxies increasing as a function of proximity to the central emission line galaxies. There is another clear trend toward a neighborhood effect within a radius of 1000 kpc for the AGN and non-AGN types: Seyfert galaxies tend to have the highest probability of having another Seyfert galaxy in the neighborhood. HII galaxies tend to have the highest probability of having another HII galaxy in the neighborhood, etc. The number of companions within 1000 kpc is inversely correlated with the Hα, [OIII] λ5007, as well as with the continuum luminosities of the central galaxies, regardless of whether they are of Seyfert, HII, or absorption line types.

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Special Announcements

2013 Carnegie Observatories Graduate Research Fellowship

We announce the continuation of the Graduate Research Fellowship at the Carnegie Observatories in Pasadena, California. This Fellowship provides a stipend to graduate students interested in carrying out all or part of their thesis research under the supervision of a Carnegie Staff member, in residence at Carnegie. We encourage applications from current Ph.D. graduate students in astronomy from an accredited (US or non-US) university, pursuing thesis research in observational astronomy, theoretical astrophysics, or instrumentation development. The student must have completed all requisite coursework and examinations prior to arriving at Carnegie. The Fellowship, beginning in September, 2013, will be awarded for one year and may be renewed for two additional years. Foreign students should note that Carnegie can only consider applicants who hold or are eligible to obtain a J-1 visa.

Carnegie Observatories provides a vibrant environment for vigorous scientific research and academic excellence. Major areas of research include cosmology and the distance scale, physics of active galactic nuclei, searches for massive black holes, galaxy formation and evolution, galaxy groups and clusters, intergalactic medium, star formation, supernovae, star clusters, and nucleosynthesis and chemical abundances of stars.

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The application should include a curriculum vitae, bibliography, brief essay describing the applicant's current research, research proposal based on a project sponsored by a Carnegie Staff member, transcript of grades, approval letter from the department head of the applicant's home institution, and three letters of reference. Applications are due by April 19, 2013, 17:00 PST. Full details of the program and application instructions can be found at this web site: http://obs.carnegiescience.edu/fellowships/gradfellowships/

Email inquiries may be sent to Dr. Luis Ho at `gradfellowships@obs.carnegiescience.edu`.