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Abstracts - Thesis Abstracts - Jobs - Meetings

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.
Matt Redman

Abstracts of recently accepted papers

A code for optically thick and hot photoionized media

Anne-Marie Dumont[1], Arnaud Abrassart[1] and Suzy Collin[1]

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We describe a code designed for hot media (T $\geq$ a few 10^4 K), optically thick to Compton scattering. It computes the structure of a plane-parallel slab of gas in thermal and ionization equilibrium, illuminated on one or on both sides by a given spectrum. Contrary to the other photoionization codes, it solves the transfer of the continuum and of the lines in a two stream approximation, without using the local escape probability formalism to approximate the line transfer. We stress the importance of taking into account the returning flux even for small column densities (10^{22} cm^{-2}), and we show that the escape probability approximation can lead to strong errors in the thermal and ionization structure, as well as in the emitted spectrum, for a Thomson thickness larger than a few tenths. The transfer code is coupled with a Monte Carlo code which allows to take into account Compton and inverse Compton diffusions, and to compute the spectrum emitted up to MeV energies, in any geometry. Comparisons with CLOUDY show that it gives similar results for small column densities. Several applications are mentioned.

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Supermassive Black Holes in Active Galactic Nuclei

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This article gives a brief overview of the direct and indirect evidence in support of the standard paradigm that active galactic nuclei are powered by supermassive black holes.

To appear in *The Encyclopedia of Astronomy and Astrophysics* (Institute of Physics Publishing).

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Supermassive Black Holes in Inactive Galaxies

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This article discusses stellar dynamical evidence for supermassive black holes in inactive and weakly active galaxies.

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Continuum-driven shocks in active galactic nuclei

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We extend the study of instabilities in flows driven by the radiation pressure of an ionizing continuum to flows which are not plane-parallel. It is well known that the plane-parallel instability leads eventually to the formation of continuum-driven shocks backed by a sonic transition. If these structures are thin, we find they are unstable to a corrugation mode, and evolve to form sharp-peaked triangular profiles. Once this has occurred, the thin shock approximation is no longer valid.

We study the further development of the shocks by numerical hydrodynamic simulations. The flow tends to break up into numerous discrete bow-shaped components. The speed of these components through the upstream material is almost constant. As a result, the maximal velocity of radiatively driven shocks through the upstream gas may be determined by instabilities rather than by other physical effects. Interactions between gas in the wings of neighbouring bowshocks can, however, form subsequent generations of bowshocks which are faster and more acute than their predecessors.

One likely location where continuum driven shocks may occur is in the broad line regions of active nuclei. We discuss the application of our results to such flows.

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Optical off-nuclear spectra of quasar hosts and radio galaxies

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We present optical (~3200A to ~9000A) off-nuclear spectra of 26 powerful active galaxies in the redshift range $0.1 < z < 0.3$, obtained with the Mayall and William Herschel 4-meter class telescopes. The sample consists of radio-quiet quasars, radio-loud quasars (all with $-23 > M_V > -26$) and radio galaxies of Fanaroff & Riley Type II (with extended radio luminosities and spectral indices comparable to those of the radio-loud quasars). The spectra were all taken approximately 5 arcseconds off-nucleus, with offsets carefully selected so as to maximise the amount of galaxy light falling into the slit, whilst simultaneously minimising the amount of scattered nuclear light. The majority of the resulting spectra appear to be dominated by the integrated stellar continuum of the underlying galaxies rather than by light from the non-stellar processes occurring in the active nuclei, and in many cases a 4000Å break feature can be identified. The individual spectra are described in detail, and the importance of the various spectral components is discussed. Stellar population synthesis modelling of the spectra will follow in a subsequent paper (Nolan et al. 2000).

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A catalogue of quasars and active nuclei (9th edition)

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Because of the fast increase in the number of known quasars, we have prepared an updated version of our catalogue of quasars and active nuclei (Véron-Cetty & Véron, 1998) which now contains 13 214 quasars, 462 BL Lac objects and 4 428 active galaxies (of which 1 711 are Seyfert 1). Like the eighth edition, it includes position and redshift as well as photometry (U, B, V) and 6 and 11 cm flux densities when available.
We also give a list of all known lensed and double quasars.

ESO Scientific Report N°19, in press

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Mid-infrared ISO spectroscopy of NGC4945

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We have observed the central region of the nearby starburst galaxy NGC 4945 with the mid-infrared spectrometers SWS and PHT-S aboard ISO. We do not find any evidence for the existence of the powerful AGN, inferred from hard X-ray observations. The upper limits on our AGN tracers [NeV] 14.32μm & 24.3μm and [NeVI] 7.65μm imply an $A_V > 160$ towards the NLR, assuming the NLR to be of equal strength as in the Circinus galaxy. Other possibilities are discussed. The starburst excitation indicators [NeIII]15.56μm/[NeII]12.81μm and L_{bol}/L_{lyc} suggest that the starburst in the central region is at least 5×10^6 yrs old, and that it accounts for at least half of the nuclear bolometric luminosity. The starburst might well power the entire bolometric luminosity, but the available constraints are also consistent with an up to 50% contribution of the embedded AGN. With PHT-S, at a resolution of $\approx$90, we detect strong absorption features of water ice, and, for the first time in an external galaxy, of CO_2 and CO. The same PHT-S spectrum also reveals strong emission from the family of PAH features. Finally, we have observed and detected several pure rotational and ro-vibrational H_2 lines, two of which, the (0-0) S(0) & S(1) lines, allow us to determine the excitation temperature (160K) and warm H_2 mass ($2.4\times10^7 M_\odot$). The low excitation temperature shows Orion-like shocks not to be representative for the entire emission of the central region of the galaxy and fairly normal PDRs to be perhaps more typical.

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Accretion and emission processes in AGN : the UV-X connection

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The main characteristics of the average spectrum of radio quiet AGN in the UV and X-ray range are reviewed, and the emission mechanisms are discussed in the framework of accretion disk models, in particular the "irradiated cold relativistic disk". It is shown that some problems arise in confronting the predictions of the model to the observations. We propose an alternative model in terms of a hot disk surrounded by a cold Compton thick medium. Finally we mention problems with remote regions of the accretion disk.

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X-ray emitting-absorbing media in Seyfert 1 galaxies

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Seyfert galaxies have been shown to exhibit a large variety of features in their X-ray spectra from which the environment of the central engine can be deduced. We focus on the two following aspects: the Warm Absorber, mainly responsible of the soft X-ray properties, and the reprocessing/reflecting plasma medium at the origin of the iron Kα fluorescent line.

The physical parameters and the location of the so-called Warm Absorber (WA), a photoionized medium along the line of sight to the nuclear region, are more strongly constrained by optical coronal lines than by the oxygen edges observed in the soft X-rays and produced by the WA. The photoionization models also predict the intensities of the X-ray emission lines which are going to be detected with the new generation of X-ray satellites.

An alternative model to the relativistic accretion disc is proposed to explain the profile of the X-ray iron Kα line observed in the Seyfert 1. This line can be formed in the framework of a quasi-spherical accretion of optically thick clouds. An optically thick photoionization code coupled with a Monte-Carlo code has been developed to compute the entire spectrum from the IR to the hard X-rays for a close geometry with a large covering factor. The multiple Compton reflections allow to reproduce the redshifted broad iron line as detected in several Seyfert 1 galaxies and in MCG-6-30-15.

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Stellar populations in Active Galactic Nuclei. II. Population synthesis

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The relationship of an AGN to its host galaxy is one crucial question in the study of galaxy evolution. We present a method to estimate the stellar contribution in active galactic nuclei. We perform stellar population synthesis in the central regions of a sample of 12 galaxies of different levels of activity: normal galaxies, starburst galaxies, LINERs, Seyfert 2 and Seyfert 1 galaxies. Quantification of the stellar contribution is carried out in the visible range (5000 and 8800 Å) using the equivalent widths of the absorption features throughout the spectrum. The synthesis is done by a variant of the new GPG method (Pelat, 1997). This method, contrary to previous ones, gives an unique solution.

We find quite different stellar populations for the different types of activity, which seems to be indicative of an age sequence. The starburst galaxies present the youngest populations of the sample. The Seyfert 2 nuclei and NGC 1275, a Seyfert 1 with signs of interaction and where young stellar clusters have been found, also show the contribution of a young population, less intense than in the starburst galaxies but metal rich. NGC 3516, a typical Seyfert 1, has a normal population characteristic of galaxies of the same Hubble type and finally the LINERs show the oldest populations in the sample, metal rich, with little star formation still going on.

It is found that a strong CaII triplet, even though these lines are sensitive to gravity, does not imply necessarily a stellar population dominated by supergiant stars.

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The Nature of Composite LINER/H II Galaxies, As Revealed from High-Resolution VLA Observations

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A sample of 37 nearby galaxies displaying composite LINER/H II and pure H II spectra was observed with the VLA in an investigation of the nature of their weak radio emission. The resulting radio contour maps overlaid on optical galaxy images are presented here, together with an extensive literature list and discussion of the individual galaxies. Radio morphological data permit assessment of the "classical AGN" contribution to the global activity observed in these "transition" LINER galaxies. One in five of the latter objects display clear AGN characteristics: these occur exclusively in bulge-dominated hosts.

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2.5–11 micron spectroscopy and imaging of AGNs: Implication for unification schemes

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We present low resolution spectrophotometric and imaging ISO observations of a sample of 57 AGNs and one non-active SB galaxy over the 2.5–11 μm range. The sample is about equally divided into type I ($\leq$ 1.5; 28 sources) and type II ($>$ 1.5; 29 sources) objects. The mid-IR (MIR) spectra of type I (Sf1) and type II (Sf2) objects are statistically *different*: Sf1 spectra are characterized by a strong continuum well approximated by a power-law of average index $\langle\alpha\rangle = -0.84 \pm 0.24$ with only weak emission features from Polycyclic Aromatic Hydrocarbon (PAH) bands at 3.3, 6.2, 7.7 and 8.6 μm. In sharp contrast to Sf1s, most Sf2s display a weak continuum but very strong PAH emission bands, with equivalent widths (EW) up to 7.2 μm. On the other hand, Sf1s and Sf2s do not have statistically different PAH luminosities while the 7 μm continuum is on the average a factor ~ 8 less luminous in Sf2s than in Sf1s. Because the PAH emission is unrelated to the nuclear activity and arises in the interstellar medium of the underlying galactic bulge, its EW is a sensitive nuclear redenning indicator. These results are consistent with unification schemes and imply that the MIR nuclear continuum source of Sf2s is, on the average, extinguished by 92 ± 37 visual magnitudes whereas it is directly visible in Sf1s. The dispersion in Sf2's PAH EW is consistent with the expected spread in viewing angles. Those Sf2s with EW(PAH) $> 5\,\mu$m suffer from an extinction $A_v > 125$ magnitudes and are invariably extremely weak X-ray sources. Such Sf2s presumably represent the highly inclined objects where our line of sight intercepts the full extent of the molecular torus. Conversely, about a third of the Sf2s have PAH EW $\leq 2\mu$m, in the range of Sf1s. Among them, those which have been observed in spectropolarimetry and/or in IR spectroscopy invariably display "hidden" broad lines. As proposed by Heisler et al (1997), such Sf2s are most likely seen at grazing incidence such that one has a direct view of *both* the "reflecting screen" *and* the torus inner wall responsible for the near and mid-IR continuum. Our observations therefore constrain the screen and the torus inner wall to be spatially co-located. Finally, the 9.7 μm Silicate feature appears weakly in emission in Sf1s, implying that the torus vertical optical thickness cannot significantly exceed $10^{24}\,\mathrm{cm}^{-2}$

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Are Narrow-Line Seyfert 1s Really Strange?

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Narrow-line Seyfert 1s (NLS1s) are generally considered to be "strange" Active Galactic Nuclei (AGNs). Surprisingly, this makes them very useful for constraining models. I discuss what happens when one attempts to qualitatively fit the NLS1 phenomenon using the stellar wind model for AGN line emission (e.g., Kazanas 1989). The simplest way of narrowing profile bases of this model to the widths observed in NLS1s is probably to lower the mass of the supermassive black hole. In a flux- and redshift-limited data set, this is indeed similar to increasing $L/L_{\rm Edd}$. Because the broad line region (BLR) of the stellar line emission model scales with the tidal radius of the stars, this model predicts maximal BLR velocities of FWZI $\propto (L/L_{\rm Edd})^{-1/3}$. This implies that the black holes of NLS1s are approximately $3^3 = 27$ times less massive than those in other Seyfert 1s if the stellar line emission model is correct. Another consequence of increasing $L/L_{\rm Edd}$ in this model is that it results in an increase in the wind edge densities. NLS1 spectra appear to support this result as well. Even the collateral features of NLS1s, such as the line asymmetries and continuum properties appear to be easily explained within the context of this model. For better or worse, if the stellar wind line emission is correct, NLS1s are not much stranger than other AGNs.

Proceedings submission for December, 1999 Bad Honnef, Germany conference, "Observational and Theoretical Progress in the Study of Narrow-Line Seyfert 1 Galaxies." To appear in *New Astronomy Reviews*.

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Meetings

"Mass Outflow in Active Galactic Nuclei: New Perspectives"

The Catholic University of America; Washington, DC
March 8 - 10, 2001 (Thurs., Fri., Sat.)

PRELIMINARY ANNOUNCEMENT

Scientific Organizing Committee:
Michael Crenshaw (Catholic University, GSFC), co-chair
Steven Kraemer (Catholic University, GSFC), co-chair
Ian George (University Space Research Association, GSFC)
Frederick Hamann (University of Florida)
John Hutchings (Dominion Astrophysical Observatory)
Smita Mathur (Ohio State University)
Norman Murray (Canadian Institute for Theoretical Astrophysics)
Hagai Netzer (Tel Aviv University)
Joe Shields (Ohio University)

New and exciting results on mass outflow from active galactic nuclei and quasars are becoming available through new space missions (HST/STIS, Chandra, FUSE, XMM), ground-based observations (e.g., adaptive optics, IR spectroscopy, spectropolarimetry), and sophisticated models. The purpose of the workshop will be to review the new observations and their implications, investigate the correspondence between the observations and models, and stimulate new directions for future collaborative efforts. Scientific topics will include intrinsic UV and X-ray absorption, broad absorption-line quasars, radial outflow in the narrow-line region, photoionization and shock models of the emission-line and absorption regions, dynamical outflow models, and connection to the central engine and broad-line region.

The conference will be held on the campus of the Catholic University of America in Washington, DC on March 8 - 10, 2001. Due to space limitations and the need for an interactive workshop, the number of participants will be limited to 80. The format of the meeting will be short oral presentations, a limited number of posters, and extensive discussions. We hope to have a limited amount of travel support for young scientists. If you wish to be included in future mailings regarding this conference, please send a message to Mike Crenshaw at crenshaw@buckeye.gsfc.nasa.gov .

The Active Galaxies Newsletter is available on the World Wide Web. You can access it via the University of Manchester home page :- http://www.ast.man.ac.uk/~mpr/agn/