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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

Intensive HST, RXTE and ASCA Monitoring of NGC 3516: Evidence Against Thermal Reprocessing

Rick Edelson[1,2], Anuradha Koratkar[3], Kirpal Nandra[4,5], Michael Goad[2], Bradley M. Peterson[6], Stefan Collier[6], Julian Krolik[7], Matthew Malkan[1], Dan Maoz[8], Paul O'Brien[2], J. Michael Shull[9], Simon Vaughan[2], Robert Warwick[2]

[1]Astronomy Department; University of California; Los Angeles, CA 90095-1562; USA
[2]X-ray Astronomy Group; Leicester University; Leicester LE1 7RH; United Kingdom
[3]Space Telescope Science Institute; 3700 San Martin Dr.; Baltimore, MD 20771; USA
[4]NASA/Goddard Space Flight Center; Laboratory for High Energy Astrophysics; Code 662; Greenbelt, MD 20771; USA
[5]Universities Space Research Association
[6]Astronomy Department; Ohio State University; 180 W. 18th Ave.; Columbus, OH 43210-1173; USA
[7]Department of Physics and Astronomy; The Johns Hopkins University; Baltimore, MD 20771; USA
[8]School of Physics & Astronomy and Wise Observatory; Tel-Aviv University; Tel-Aviv 69978; Israel
[9]Center for Astrophysics and Space Astronomy; University of Colorado; Boulder, CO 80309; USA

During 1998 April 13–16, the bright, strongly variable Seyfert 1 galaxy NGC 3516 was monitored almost continuously with *HST* for 10.3 hr at ultraviolet wavelengths and 2.8 d at optical wavelengths, and simultaneous *RXTE* and *ASCA* monitoring covered the same period. The X-ray fluxes were strongly variable with the soft (0.5–2 keV) X-rays showing stronger variations (∼65% peak-to-peak) than the hard (2–10 keV) X-rays (∼50% peak-to-peak). The optical continuum showed much smaller but still highly significant variations: a slow ∼2.5% rise followed by a faster ∼3.5% decline. The short ultraviolet observation did not show significant variability.

The soft and hard X-ray light curves were strongly correlated with no evidence for a significant interband lag. Likewise, the optical continuum bands (3590 Å and 5510 Å) were also strongly correlated with no measurable lag to 3σ limits of $\lesssim$0.15 d. However, the optical and X-ray light curves showed very different behavior, and no significant correlation or simple relationship could be found. These results appear difficult to reconcile with previous reports of correlations between X-ray and optical variations and of measurable lags within the optical band for some other Seyfert 1s.

These results also present serious problems for "reprocessing" models in which the X-ray source heats a stratified accretion disk which then reemits in the optical/ultraviolet: the synchronous variations within the optical would suggest that the emitting

region is $\lesssim$0.3 lt-d across, while the lack of correlation between X-ray and optical variations would indicate, in the context of this model, that any reprocessing region must be $\gtrsim$1 lt-d in size. It may be possible to resolve this conflict by invoking anisotropic emission or special geometry, but the most natural explanation appears to be that the bulk of the optical luminosity is

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rae@astro.ucla.edu

The Radio Jets and Accretion Disk in NGC 4261

D. L. Jones[1], A. E. Wehrle[2] , D. L. Meier[1], and B. G. Piner[1]

[1] Jet Propulsion Laboratory, Caltech, Mail Code 238-332, 4800 Oak Grove Drive, Pasadena, CA 91109, USA
[2] Jet Propulsion Laboratory, Caltech, Mail Code 301-486, 4800 Oak Grove Drive, Pasadena, CA 91109, USA

The structure of AGN accretion disks on sub-parsec scales can be probed through free-free absorption of synchrotron emission from the base of symmetric radio jets. We present new VLBA observations of the nearby FR-I radio galaxy NGC 4261 at 22 and 43 GHz, and combine these with previous VLBA observations at 1.6 and 8.4 GHz to map absorption caused by an inner accretion disk. Assuming the disk is geometrically and optically thin and composed of a uniform 10^4 K plasma, the average electron density in the inner 0.1 pc is $10^{-3} - 10^{-8}$ cm^{-3}. Equating thermal gas pressure and magnetic field strength gives a disk magnetic field of $10^{-4} - 10^{-2}$ G at 0.1 pc. The jet opening angle is between 0.3 and 20 degrees during the first 0.2 pc of the jet, and must be less than 5 degrees during the first 0.8 pc. We include an appendix containing expressions for a simple, optically thin, gas pressure dominated accretion disk model which may be applicable to other galaxies in addition to NGC 4261.

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E-mail contact: dj@bllac.jpl.nasa.gov,
preprint available at http://xxx.lanl.gov/abs/astro-ph/9912525

AGN, a natural stage in galaxy evolution?

Suzy Collin

Observatoire de Paris-Meudon, 92195 Meudon, France

Recent X-ray observations have definitively proved the presence of a Massive Black Hole (MBH) powered by accretion in Se= yfert 1 nuclei. Taking then as a basic definition of Active Galactic Nuclei (AGN) that they harbor an accreting MBH and using a few empirical similarities with Seyfert 1 nuclei, one can show that AGN encompass a broad category of objects, from very luminous quasars to very weak LINERs. Their observed diversity can be accounted for by the variation of a few parameters: the orientation of the rotation axis of the accreted gas (the so-called Unified Scheme), the mass of the black hole, its angular momentum, and its accretion rate, the efficiency of transformation of mass into energy, the environment (starburst, amount of dust...). In particular they can suffer transitions between low and high accretion rates (expressed in terms of the critical accretion rate): for instance our galactic center could well undergo episodes of NLS1 stage. Thus, according to the work of Ho et al 1997, almost half of nearby nuclei of galaxies harbor an AGN. This result is in agreement with the relation between the mass of the central black hole and the luminosity of the bulges of galaxies (Margorrian et al 1998), and roughly with the mass locked in "dead" quasars in the local universe, implying that a large fraction of the mass presently locked in MBHs has been accreted early in the past. So one can address the question of whether all galactic nuclei have gone through an active phase in the past. Clues to this problem might be obtained by understanding the connection between ultraluminous infrared galaxies and AGN.

to appear in Proceedings of the XIXth Moriond "Building galaxies: from the primordial Universe to the present", Eds F. Hammer, T.X. Thuan, V. Cayatte, B. Guiderdoni and J. Tran Thanh Van, Ed. Frontières, p. 321

E-mail contact: suzy.collin@obspm.fr

Optical variability of B L Lacertae during the major outburst of 1997

K. K. Ghosh[1], B.D. Ramsey[1],A. C. Sadun[2],S. Soundararajaperumal[3] and J. Wang[4]

[1] NASA/MSFC, Space Science Department, SD50, Huntsville, AL, 35812, USA
[2] University of Colorado at Denver,Department of Physics, Campus Box 157, P.O. Box 173364, Denver, CO 80217-3364
[3] Indian Institute of Astrophysics, Bangalore 560 034, India
[4] Yunnan Observatory, Chinese Academy of Sciences, China

We have undertaken an investigation of recent flux variability in BL Lac. We present optical observations taken over 12 nights

documenting major as well as minor outbursts. This has been combined, for purposes of multifrequency analysis, with published X-ray and gamma-ray data taken for an additional single night. On two nights in particular, which includes the night of the X-ray observations, a major outburst of about a full magnitude of variation was recorded.

All the data have been analyzed with theoretical models. Attempts were made to use synchrotron self-Compton and external Comptonization models to explain the data; however both classes of models were found lacking. More satisfactory results were obtained using an analytical model proposed by Wang et al. that involves the evolution of synchrotron spectra in a homogeneous jet due to the injection of relativistic electrons, taking into account radiation losses during the outbursts. It is hoped that the results of this study of BL Lac, an archetype for the class of blazars in general, represent a more generic phenomenon applicable to the entire class.

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E-mail contact: kajal.ghosh@msfc.nasa.gov

On The Reddening in X-ray Absorbed Seyfert 1 Galaxies

S. B. Kraemer[1], I. M. George[2], T. J. Turner[3], & D. M. Crenshaw[1]

[1] Catholic University of America, NASA's Goddard Space Flight Center, Code 681,Greenbelt, MD 20771
[2] Universities Space Research Association, NASA's Goddard Space Flight Center, Code 660, Greenbelt, MD 20771
[3] University of Maryland, Baltimore County, NASA's Goddard Space Flight Center, Code 660, Greenbelt, MD 20771

There are several Seyfert galaxies for which there is a discrepancy between the small column of neutral hydrogen deduced from X-ray observations and the much greater column derived from the reddening of the optical/UV emission lines and continuum. The standard paradigm has the dust within the highly ionized gas which produces O VII and O VIII absorption edges (i.e., a "dusty warm absorber"). We present an alternative model in which the dust exists in a component of gas in which hydrogen has been stripped, but which is at too low an ionization state to possess significant columns of O VII and O VIII (i.e, a "lukewarm absorber"). The lukewarm absorber is at sufficient radial distance to encompass much of the narrow emission-line region, and thus accounts for the narrow-line reddening, unlike the dusty warm absorber. We test the model by using a combination of photoionization models and absorption edge fits to analyze the combined *ROSAT/ASCA* dataset for the Seyfert 1.5 galaxy, NGC 3227. We show that the data are well fit by a combination of the lukewarm absorber and a more highly ionized component similar to that suggested in earlier studies. We predict that the lukewarm absorber will produce strong UV absorption lines of N V, C IV, Si IV and Mg II. Finally, these results illustrate that singly ionized helium is an important, and often overlooked, source of opacity in the soft X-ray band (100 - 500 eV).

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E-mail contact: stiskraemer@yancey.gsfc.nasa.gov

The emission line spectrum of active galactic nuclei and the unifying scheme

M.-P. Véron-Cetty[1], P. Véron[1]

[1] Observatoire de Haute Provence, CNRS, F-04870 Saint-Michel l'Observatoire

Recent papers dealing with the most controversial aspects of AGNs are reviewed. They suggest interesting conclusions: all Seyferts can be described by a single parameter, the X-ray column density; radio loud AGNs may host a rapidly spinning black hole and radio quiet AGNs a slowly spinning black hole; high-ionization AGNs (Seyfert galaxies and QSOs) contain an optically thick, geometrically thin accretion disk, while low-ionization AGNs (Liners) contain an optically thin, geometrically thick accretion disk; a number of blazars have been classified as BLLs on the basis of insufficient data; most objects with weak broad emission lines are in fact HPQs; many objects have been called Liners although they are not AGNs but rather the result of stellar activity; type 2 QSOs exist, but are quite inconspicuous if radio quiet.

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E-mail contact: mira@obs-hp.fr,
preprint available at http://www.obs-hp.fr/www/preprints.html

The giant X-ray outbursts from nearby, *non-active* galaxies: tidal disruption flares ?

Stefanie Komossa[1]

[1] Max-Planck-Institut für extraterrestrische Physik, Giessenbachstrasse, 85748 Garching, Germany

One efficient method to probe the direct vicinity of SMBHs in nearby galaxies is to make use of the detection of flares from tidally disrupted stars (e.g., Lidskii & Ozernoi 1979, Rees 1988). The first few excellent candidates for the occurrence of this process in non-active galaxies have emerged recently. Here, we present a review of these observations, compare with variability in AGN, and discuss theoretical implications. We concentrate on the cases of NGC 5905 and RXJ1242-1119, and report results from a systematic search for further X-ray flares from a sample of >100 nearby galaxies.

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E-mail contact: skomossa@xray.mpe.mpg.de;
Preprint and related papers are available at http://www.xray.mpe.mpg.de/~skomossa/

Warm Absorbers in AGN

Stefanie Komossa[1]

[1] Max-Planck-Institut für extraterrestrische Physik, Giessenbachstrasse, 85748 Garching, Germany

We first provide a review of the properties of warm absorbers concentrating on what we have learned from *ROSAT* and *ASCA*. This includes dusty and dust-free warm absorbers, non-X-ray emission and absorption features of warm absorbers, and the possible warm absorber interpretation of the peculiar 1.1 keV features.

We then discuss facets of warm absorbers by a more detailed investigation of individual objects: In a first part, we discuss several candidates for dusty warm absorbers. In a second part, we review and extend our earlier study of a possible relation between warm absorber and CLR in NGC 4051, and confirm that both components are of different origin (the *observed* coronal lines are *under*predicted by the models, the warm absorber is too highly ionized). We then suggest that a potential overprediction of these lines in more lowly ionized absorbers can be avoided if these warm absorbers are dusty. In a third part, we present first results of an analysis of a deep *ROSAT* PSPC observation of the quasar MR2251–178, the first one discovered to host a warm absorber. Finally, we summarize our scrutiny under which conditions a warm absorber could account for the dramatic spectral variability of the Narrow-line Seyfert 1 galaxy RXJ0134-4258.

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E-mail contact: skomossa@xray.mpe.mpg.de;
Preprint and related papers are available at http://www.xray.mpe.mpg.de/~skomossa/

The stellar population and the evolutionary state of HII regions and starburst galaxies

Rosa M. González Delgado[1]

[1] Instituto de Astrofisica de Andalucia (CSIC), Granada, Spain

RH IIs and starbursts are both powered by massive stars. They are the main contributors to the heating of the ISM via radiative and mechanical energy. Techniques to derive the stellar content and the evolutionary state of RH IIs and starbursts from their ultraviolet and optical integrated light are reviewed. A prototypical RH II (NGC 604) and nuclear starburst (NGC 7714) are discussed in more detail. The results reveal the necessity of multiwavelength analyses of these objects to estimate their stellar content and their evolutionary state in a consistent way.

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E-mail contact: rosa@iaa.es,
preprint available at http://www.iaa.csic.es/~rosa

Elemental Abundances of High Redshift Quasars

Matthias Dietrich[1,2], **and U. Wilhelm-Erkens**[1]

[1] Landessternwarte Heidelberg, Königstuhl, D-69117 Heidelberg, Germany
[2] Department of Astronomy, University of Florida, 211 Bryant Space Science Center, Gainesville, FL 32611-2055, USA

A sample of 16 high redshift quasars with $2.4 \lesssim z \lesssim 3.8$ was observed with moderate spectral resolution in the restframe ultraviolet. The emission-line fluxes of NV 1240, CIV1549, and HeII1640 were used to estimate the metallicity of the line emitting gas. The line ratios were investigated within the frame work of models presented by Hamann & Ferland (1992, 1993, 1999). The scaled solar abundance model yields inconsistent results for the metallicity while the rapid star formation scenario is successful in indicating a common range of overabundance on base of NV1240/CIV1549 and NV1240/HeII1640 line ratios. We estimated an abundance of $Z \simeq 8\,Z_\odot$ of the line emitting gas given by NV/CIV and NV/HeII. Assuming an evolution time scale of $\sim$1 Gyr

and a cosmological model with $\Omega_M \simeq 0.3$, $\Omega_\Lambda \simeq 0.7$, and $H_o \simeq 65$ km s^{-1} Mpc^{-1} the first violent star formation epoch should start at a redshift of $z_f \simeq 6$ to 10.

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E-mail contact: dietrich@astro.ufl.edu

Spectroscopic Study of High Redshift Quasars

M. Dietrich[1], I. Appenzeller[1,4], S.J. Wagner[1], W. Gässler[3], R. Häfner[3], H.-J. Hess[3],W. Hummel[3], B. Muschielok[3], H. Nicklas[2], G. Rupprecht[5], W. Seifert[1], O. Stahl[1], T. Szeifert[5,1], and K. Tarantik[3]

[1] Landessternwarte Heidelberg, Königstuhl, D-69117 Heidelberg, FRG
[2] Universitätssternwarte Göttingen, Geismarlandstr. 11,

D-37083 Göttingen, FRG
[3] Universitätssternwarte München, Scheinerstr. 1, D-81679 München, FRG
[4] Max-Planck-Institut für Astronomie, Königstuhl, D-69117 Heidelberg, FRG
[5] ESO, Karl Schwarzschild-Str.2, D-85740 Garching, FRG

We obtained optical spectra of four quasars with $3<z<4$ and SDSSp J033829.31+002156.3 with $z=5.0$ with FORS 1 at the VLT UT1 Antu. To estimate the relative abundances of the line emitting gas we used the line ratios NV1240/CIV1549, NV1240/HeII1640, and OVI1034/HeII1640 as suggested by Hamann & Ferland (1992, 1999). Based on chemical evolutionary models we estimate a metallicity of $Z \simeq 7\,Z_\odot$ for the quasars with $z \simeq 3$ within the framework of the rapid star formation scenario. Even Q0338+0021 indicates a comparable high relative abundance. Qur results provide support for supersolar metallicities at very high redshifts of $z \simeq 5$.

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E-mail contact: dietrich@astro.ufl.edu

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