Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
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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

Monitoring Lyα Emission from the Blazar 3C 279

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The blazar 3C 279 is well studied and shows frequent large continuum flares from radio to γ-ray wavelengths. There have been a number of multi-wavelength observations of 3C 279, and hence there are many ultraviolet data for this object available in the UV archives. In this paper we present Lyα emission line measurements for 3C 279 using all the archival *IUE* SWP spectra from 1988 to 1996 and all archival *HST/FOS* G190H spectra from 1992 to 1996.

Individual archival *IUE* spectra of 3C 279 show weak Lyα emission at ~1868 Å ($z = 0.536$), which is easily seen in the co-added data. The Lyα emission is observed in all the *HST/FOS* spectra. The strength of Lyα is nearly constant (~5 $\times 10^{-14}$ erg cm^{-2} s^{-1}), while the 1750 Å continuum varies by a factor of ~50, from ~ 0.6 to 31.6 $\times 10^{-15}$ erg cm^{-2} s^{-1} Å^{-1}.

The behavior of the Lyα emission line flux and continuum flux is similar to that of the only other well observed blazar, 3C 273, which shows constant line flux while the continuum varies by a factor of ~3. This near-constancy of emission line flux in the two best-studied blazars, suggests that the highly variable beamed continuum is not a significant source of photoionization for the gas. Some other source, such as thermal emission from an accretion disk, must be providing a significant fraction of the photoionizing flux in these objects. The large amplitude variability seen at γ-ray energies must be due to changes in the energetic electrons in the jet rather than changes in the external photon field.

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A Detailed Comparison of *HST/FOS* and *IUE* UV Spectra of Selected Seyfert Nuclei

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Despite the contributions of the *Hubble Space Telescope (HST) Faint Object Spectrograph (FOS)* to the archive of UV observations of active galactic nuclei, the vast majority of UV reference data were obtained using the *International Ultraviolet Explorer (IUE)* satellite. These data remain important since they provide historical information about the intensities of the UV continua and emission lines that is needed to constrain models of the active nucleus. A detailed comparison of the *FOS* and *IUE* data is critical to understanding how the measurable quantities depend on the individual instrumental calibrations, and how any conclusions derived from modeling the observations may vary depending on the source of the UV data. Rigorous comparison of *FOS* and *IUE* spectra have so far been performed only for spectrophotometric standard star observations that are acquired accurately and have high signal-to-noise. We compare typical *FOS* spectra that were not acquired and observed with the strict regimen that is used for standard star observations, especially in the pre-COSTAR era.

All non-proprietary UV *FOS* spectrophotometric archival data for the Seyfert 1 galaxies MKN 509, NGC 3783, and NGC 5548 that have near simultaneous (within 24 hours) *IUE* observations are used in the analysis. These data demonstrate that the absolute photometric calibrations of the *FOS* and *IUE* agree within $\sim 5\%$ in absolute flux for two of the objects. For NGC 5548, the *FOS* and *IUE* flux data disagree by $\sim$50% in the 1200–2000Å region. In this object there may be evidence for flux non-linearity of the *IUE* detector , and a contribution from the host galaxy redward of 2800Å in the *IUE* spectrum. Cross correlation of the *FOS* and *IUE* spectra reveals no zero point wavelength shift larger than the *IUE* wavelength calibration errors. Comparison of line flux measurements from both the *FOS* and *IUE* spectra show that for strong emission lines (e.g., Lyα, C IV, and Mg II) the measured intensities always agree within 15%, while for moderately strong lines (e.g., N V, Si IV/O IV, He II, and C III]) the agreement is $\sim$30% (1σ). Weak lines (e.g., O I, C II, N IV], O III], and N III]) may not even be detected in the *IUE* spectra, and when they are detected the disagreement between the measured fluxes can be very large.

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Subarcsec structures in the double nucleus of NGC 6240 disclosed with HST at 370, 430 and 500 nm

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We present an analysis of three medium band width (FWHM $\sim 400 - 450$ Å) images of the nuclear region of NGC 6240 taken with the pre-COSTAR Faint Object Camera (FOC) on board of the *Hubble Space Telescope*. The first filter band comprises the [OII]λ3727 doublet, the second measures the blue continuum around 4400 Å and the third includes Hβ + [OIII]$\lambda\lambda$4959, 5007. The images show that the apparent two galactic nuclei B (north) and A (south) identified from the ground consist of compact subtructures on the tenth-arcsec scale plus faint extended emission on the arcsec scale. Within a diameter of 0.26" ($\sim$ 120 pc), most compact features exhibit a summed line luminosity $L([\mathrm{OIII}] + \mathrm{H}\beta)$ in the range 10^{39}–10^{40} erg s^{-1} which is comparable to that of giant HII regions.

Although the data are not complete enough for a direct decomposition into line and continuum flux, probable solutions yield a LINER like [OII]/[OIII]/Hβ line ratio for the northern compact subcomponent B1. In the southern nucleus A the faint subcomponents A2 and A3 can be classified as LINER like if they are more strongly reddened than B1 or as HII-region like if not.

The brightest southern compact component A1, however, exhibits line ratios that are typical of (i) a Seyfert galaxy or (ii) a high-excitation HII region. This leads to the interesting alternative that there is either (i) a hidden AGN (which is in accord with recent ASCA observations) or (ii) a hidden cluster of young massive stars. The second possibility would imply localized ongoing star formation within an environment whose visible light is dominated by radiation from older stellar populations. However, considering recent models for fast autoionizing shocks computed by Dopita & Sutherland (1995), A1 might also represent a shock-plus-precursor region.

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Ring-Like Structure in the Radio Lobe of MG0248+0641

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We present radio and optical observations of MG0248+0641, which contains a kiloparsec-scale ring-like structure in one of its radio lobes. The radio observations show a typical core-double morphology: a central core between two lobes, each of which has a hotspot. The western radio lobe appears as a nearly continuous ring, with linear polarization electric field vectors which are oriented in a radial direction from the ring center. We consider several different interpretations for the nature of this ring, including gravitational lensing of a normal jet by a foreground galaxy. Even though simple lensing models can describe the ring morphology reasonably well, the high linear polarization seen around the ring cannot be easily explained, and no lensing object has yet been found in deep optical and infrared searches within the extent of the ring. If the radio ring is indeed caused by gravitational lensing, the implied mass-to-light ratio is typical of the very high values seen in other candidate "dark" gravitational lenses. The chance interposition of a galactic supernova remnant, nova, planetary nebula, or H II region, has been ruled out. The highly polarized ring of MG0248+0641 is much like the prominent ring seen in 3C219, and the multiple ones in 3C310 and Hercules A, suggesting that similar physical processes are producing shell structures in these radio galaxies. The ring in MG0248+0641 may be caused by the formation of "bubbles", as a result of instabilities in the energy flow down the western radio jet. It may also be possible that the required instabilities are triggered by the infall of gas, via tidal interaction of the central source with a nearby galaxy. This scenario may be indicated by our marginal detection of an optical source close to the western hotspot.

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preprint available at astro-ph/9708152

UV Diagnostics for the Emission Line Gas in Active Galaxies

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Optical diagnostic diagrams are frequently ambiguous as a test of the photoionization or fast shock models of the narrow line regions of active galaxies. Here, we present a set of UV line ratio diagrams which can discriminate between pure shock and photoionization modes of excitation, and to some extent, also discriminate shocks with ionized precursors from photoionization. These diagrams use relatively bright emission lines and reddening insensitive ratios and provide a practical observational test for separating the excitation mechanisms of the narrow line regions of active galaxies. The most useful diagrams are those involving the various ionization stages of Carbon, [OIII] $\lambda5007$/Hβ *vs.* CIV $\lambda1549$/HeII $\lambda1640$ and the purely UV ratio pair CII] $\lambda2326$/CIII] $\lambda1909$ *vs.* CIV $\lambda1549$/CIII] $\lambda1909$. Temperature sensitive FUV lines CIII $\lambda977$ and NIII $\lambda991$ also provide good discriminants. The models are compared to observations of nearby AGN, and also to high redshift objects where the UV lines are shifted into the optical.

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The LINER Nucleus of M87: A Shock-Excited Dissipative Accretion Disk

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We present long-baseline FOS spectra of the nuclear accretion disk in M87 (NGC 4486), offset from the nucleus by 0.6" (42.7

pc) in order to a void the nuclear continuum. Even so close to the nucleus, the optical spectrum has the appearance of a normal LINER galaxy. We show that the presence of strong UV emission lines provides a definitive test of the excitation mechanism; the disk is shock excited, not photoionized by a UV continuum from the central source. The shock velocity inferred (265 km s^{-1}) is about half of the Keplerian rotation velocity found by Ford et al. (1994). Since shock dissipation appears to be the principle means of increasing the binding energy of the accreting gas, we can use the FOS data and the luminosity profile of the accretion disk to estimate the rate of mass accretion as a function of radius. We find that this decreases with decreasing distance from the nucleus, as the material becomes organized into a cool and thin classical accretion disk in the inner regions. In the outer disk the accretion rate ($\sim 4\,M_{\odot}\mathrm{yr}^{-1}$) is comparable with that determin ed for the X-ray emitting cooling flow, showing that a large fraction of the cooling gas can find its way into the nuclear regions. The accretion rate near to the nucleus ($\sim 3\times10^{-2}\,M_{\odot}\mathrm{yr}^{-1}$) is consistent with the properties of the relativistic jet and its associate d radio emission. Over the lifetime of the jets, about $10^7\,M_{\odot}$ of cool material may have accumulated in the nuclear regions, allowing the formation of a disk which is optically thick to Thompson scattering where it becomes ionized close to the nucleus. We speculate that LINER emission is a general property of the shocked dissipative regions of accretion disks in active galaxies with strongly sub-Eddington accretion, and may therefore be used as a diagnostic of these dissipative accretion flows.

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Diffraction-limited 76 mas Speckle Masking Observations of the Core of NGC 1068 with the SAO 6 m Telescope

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We present the first K-band bispectrum speckle interferometry of NGC 1068 with an angular resolution of 76 mas ($\sim$ 5.5 pc). This angular resolution allows us to attribute the measured flux to only one of the nuclear sources seen at radio wavelengths. The observed decreasing visibility function suggests that the dominant central core is probably not an unresolved point source, but slightly resolved with a FWHM diameter of $\sim$ 30 mas $\sim$ 2 pc for an assumed Gaussian intensity distribution. This 30 mas object is possibly the nuclear torus and/or a scattering halo. We discuss different contributions to the observed K band flux. Between 5 GHz and the K-band the spectrum of this component is close to a $\nu^{1/3}$ proportionality. In addition to the standard interpretation of a hot dust torus surrounding the nucleus of NGC 1068, one cannot exclude the possibility that a sizeable fraction of the nuclear flux reaches us via a scattering halo. This then would allow us to determine physical parameters of the nuclear source.

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Spectropolarimetry of the Circinus galaxy

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High quality 4500–6800 Å spectropolarimetric observations of the Circinus galaxy are reported. These show polarized and relatively broad (FWHM$\sim$3300 km/s) Hα (as well as marginal Hβ) arising from a $<3''$ ($<$60 pc) region centered on the nucleus and coincident with the the peak of the narrow line region. Broad Hα might also be present $\sim 8''$ (160 pc) SE from the nucleus and close to the dust lane, but the result is only marginal and should be verified by higher s/n data. The continuum is dominated by stellar emission with $\lesssim$3% contribution from the scattered AGN continuum, and *all the light* (i.e. all the stellar continuum and narrow lines) is polarized, most probably by transmission through and scattering by dust in the disk. The data are compatible with a simple model where the scattered broad lines and AGN emission are quite polarized (P$\sim$25%) but account for only 1% of the observed continuum. The scattered broad Hα has an equivalent width $W_\lambda \simeq 400$ Å, a flux similar to the narrow Hα and a luminosity $\simeq 5\ 10^5\ L_{\odot}$. Assuming an efficiency of 1% for the BLR mirror, the intrinsic luminosity of the broad Hα is roughly $5\,10^7\ L_{\odot}$ and $\sim$0.5% of the FIR luminosity, a ratio similar to those found in type 1 Seyferts. Specific prediction for future observations are also presented.

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ISO observations of the radio-loud BALQSO 1556+3517

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To date, the quasar 1556+3517 is the only radio loud Broad Absorption Line QSO (BALQSO; Becker et al. 1997). This prompted narrow band filter imaging observations in the range 4–15 μ with the ISO satellite. The source is clearly detected in all filters and appears point-like and isolated at the resolution of ISO. The overall Spectral Energy Distribution (SED) in erg s^{-1} peaks at a rest wavelength $\geq$ 6 μ and is reddened by 1.6 visual magnitudes. Correction for reddening brings 1556+3517 within 1.3 sigma from the $\log R = 1$ dividing line between radio-loud and radio-quiet sources. The mid-IR luminosity integrated over the 1.8–6 μ rest wavelength range is $\sim 2\,10^{46}\,\mathrm{erg\,s^{-1}}$ ($H_0 = 75\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$, $q_0 = 0$), which requires at least $4\,M_\odot$ of dust and $800\,M_\odot$ of associated gas. It is unlikely that such a large mass stems from the BAL wind itself.

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Meetings

Quasars as Standard Candles for Cosmology

La Serena, Chile
1998 May 18-22

Quasars' spectra depend on their luminosities. Can this be calibrated well enough at any wavelength, in either fixed or relative terms, to use them as standard candles in cosmological tests? This workshop is intended to review recent progress on correlations between the luminosities and spectral properties of quasars, and to revive interest in quasars as probes of cosmology.

We will specifically address the following interwoven questions: What observational correlations with luminosity exist? What is the current observational situation for luminosity correlations with the emission line spectrum? Can the correlation and scatter in the Baldwin effect be understood?

How does the shape of the ionizing continuum change with luminosity? Does the shape of the extreme UV continuum change with the UV - X-Ray spectral index? What does theory predict? What do the observations say? What is the chemical composition of the gas near quasars? How does the composition change with luminosity and what effects might these changes have on the emission/absorption spectrum?

Are changes in the abundances and continuum shape enough to account for the Baldwin effect? What other agents might come into play? How does our current understanding of the emission line regions, the intrinsic absorption regions, and the central engine affect our ability to use quasars as standard candles? How can this be improved?

The home page is http://nimbus.pa.uky.edu/QuasarLuminosity/

The Connection Between Normal and Active Galaxies

A session to be held at the 32nd COSPAR meeting
Nagoya, Japan
1998 July 12-18

We would like to announce an exciting session that we are organizing as part of the 32nd COSPAR meeting next July (12-18) in Nagoya, Japan on "The Connection Between Normal and Active Galaxies." We believe that this session will provide a rare opportunity for rich scientific interactions between the researchers in both normal and active galaxies.

The meeting currently has been allocated only one and a half days. In light of the preliminary agenda and the interest so far expressed by many colleagues, we are hoping to extend the meeting to three full days.

We encourage the submission of abstracts both for contributed talks and for posters. Abstracts are due by January 9th, and should be sent simultaneously to kinney@stsci.edu (or fax number 410-338-4579) and to the COSPAR central office (cospar@copernicus.org, or fax number 49-5556-4709). The tex form and style file can be retrieved from the web address given below. All participants who want to present results must submit abstracts.

A full description of the scientific goals of the meeting, the preliminary list of invited speakers, and additional details can be found at the web site http://www.copernicus.org/COSPAR/.

Sincerely,
Organizing Committee:
Luis Ho, Satoru Ikeuchi, Anne Kinney, Henrique Schmitt, Yutaka Uchida

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