AGN Winds in Charleston - Program

Day 1: Friday, October 14, 2011

6:00 9:00 pm *Reception and Registration at the Faculty House*
20 Glebe Street, Charleston, South Carolina

Day 2: Saturday, October 15, 2011

202 Calhoun Street, Charleston, South Carolina

08:15 08:45 am Registration

Session 1: Spectroscopic Observations of AGN Outflows - X-rays and Higher Energies

08:45	09:00 AM	Welcome	Mike Auerbach, SSM Dean
09:00	09:25 AM	*X-ray Spectral Signatures of Outflows in AGN* (20+5)	Tracey Jane Turner
09:25	09:50 AM	*Winds and X-ray Reverberation in AGN* (20+5)	Lance Miller
09:50	10:10 AM	*Anatomy of an Outflow: Mapping the Mrk 509 Warm Absorber* (15+5)	Jelle Kaastra
10:10	10:40 AM	Coffee/Tea Break	
10:40	11:05 AM	*X-ray Evidence for Ultra-fast 0utflows in Local AGNs* (20+5)	Francesco Tombesi
11:05	11:30 AM	*Energetic Accretion Disk Winds - The Case of PDS 456 and PG 1211+143* (20 + 5)	James Reeves
11:30	11:50 AM	*The Suzaku View of Fe K Band Absorption in AGN*(15+5)	Jason Gofford
11:50	12:10 PM	*Variable X-ray Absorption in the miniBAL QSO PG 1126-041* (15 + 5)	Margherita Giustini
12:10	02:00 PM	Lunch	

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02:00	02:20 PM	*Multi-wavelength Survey of AGN Outflows in a Sample of Local AGNs* (15+5)	Lisa Winter
02:20	02:40 PM	*The Chandra Survey of Outflows in AGN with Resolved Spectroscopy (SOARS): Mapping the Kinematics and Geometries of AGN Winds in Seyfert Galaxies* (15+5)	Dan Evans
02:40	03:00 PM	*A New Model of AGN X-ray-optical SEDs and Their Relevance to Outflows* (15+5)	Martin Ward
03:00	03:20 PM	*AGN Winds with Athena* (15+5)	Massimo Cappi
03:20	03: 50 PM	Coffee/Tea Break	

Session 2:Spectroscopic Observations of AGN Outflows - Near-UV and Lower Energies

03:50	04:15 PM	*Narrow Absorption Line Outflows from Quasars (20+5)*	Fred Hamann
04:15	04:40 PM	*A Census of Narrow CIV Absorption Lines in Quasars at 1.9< z< 4. 6* (20+5)	Leah Simon
04:40	05:00 pm	*Exploring Micro-Turbulence in Intrinsic UV Absorbers* (15+5)	Steve Kraemer
05:00	05:20 PM	*Reorienting Our Perspective of Broad Absorption Line Quasars* (15+5)	Michael DiPompeo
08:30 AM - 06:30 PM		Posters	

AGN Winds in Charleston - Program

Day 3: Sunday, October 16, 2011

8:30	9:00 AM	Registration	

Session 3: Spectroscopic Observations of AGN Outflows - Near-UV and Lower Energies

09:00	09:25 AM	*CIV Emission as a Probe of Accretion Disk Winds* (20+5)	Gordon Richards
09:25	09:50 AM	*Probing High-column Outflows in BALQSOs Using Metastable Helium* (20+5)	Karen Leighly
09:50	10:10 AM	*BAL Quasars with Redshifted Absorption* (15+5)	Patrick Hall
10:10	10: 30 AM	*The Multiwavelength Campaign on Mkn 509: Characterizing the UV and X-ray Outflow* (15+5)	Gerard Kriss
10:30	11:00 AM	Coffee/Tea Break	
11:00	11:25 AM	*Broad Absorption Line Variability on Multi-Year Timescales: Current Results and Future SDSS-III Prospects* (20+5)	Niel Brandt
11:25	11:50 AM	*Variability in Quasar Broad Absorption Line Outflows* (20 + 5)	Daniel Capellupo
11:50	12:10 PM	*Variability of mini-BAL and BAL Outflows in Quasars* (15 + 5)	Paola Rodriguez Hidalgo
12:10	02:00 PM	Lunch	

AGN Winds in Charleston - Program

Session 4: Imaging and Spatially Resolved Spectroscopy of AGN Winds

02:00	02:25 PM	*Outflows in Nearby AGN from Integral Field Spectroscopy* (20+5)	Thaisa Storchi Bergmann
02:25	02:50 PM	*Massive Neutral and Molecular Winds in Nearby Galaxies* (20+5)	Sylvain Veilleux
02:50	03:10 PM	*High-ionization Gas in Active Galactic Nuclei: Line Profiles and Physical Conditions* (15+5)	Alberto Rodríguez Ardila
03:10	03:40 PM	Coffee/Tea Break	
03:40	04:05 PM	*Evidence for Termination of Obscured Starbursts by Radiatively Driven Outflows in Reddened QSOs* (20+5)	Duncan Farrah
04:05	04:25 PM	*AGN Narrow-Line Kinematics: Determining Inclinations via Outflows* (15+5)	Travis C. Fischer
04:25	04:45 PM	*Lower Limits on the Metallicity of SDSS BALQ Outflows* (15+5)	Alexei Baskin
04:45	05:05 PM	*The Lick AGN Monitoring Project 2011: Dynamical Modeling of High-quality Reverberation Mapping Data* (15+5)	Anna Pancoast
08:30 AM - 06:30 PM		Posters	

AGN Winds in Charleston - Program

Day 4: Monday, October 17, 2011

Session 5: Simulations and Energetics of AGN Winds

09:00	09:25 AM	*Simulations of AGN Winds* (20+5)	Daniel Proga
09:25	09:50 AM	*Radiation-MHD Simulations of Black Hole Accretion Flows and Outflows* (20+5)	Ken Ohsuga
09:50	10:10 AM	*MHD Winds As X-ray/UV Absorbers in AGN* (15+5)	Demos Kazanas
10:10	10:40 AM	Coffee/Tea Break	
10:40	11:00 AM	*AGN Structure and the 3 Forms of Radiation Driving* (15+5)	Martin Elvis
11:00	11:20 AM	*A Radiative Transfer Code for Modelling (BAL)QSOs* (15+5)	Nick Higginbottom
11:20	11:40 AM	*Looking for the Wind in the Dust* (15+5)	Sarah Gallagher
11:40	12:00 PM	*Anisotropic Dust-driven Winds Simulated Using Monte Carlo Radiative Transport* (15+5)	Nathaniel Roth
12:00	1:20 PM	Lunch	
01:20	01:40 PM	*X-ray Signatures of AGN Outflows: Multi-dimensional Radiative Transfer Simulations* (15+5)	Stuart Sim
01:40	02:00 PM	*A Global View of AGN Ionized Winds* (15+5)	Keigo Fukumura
02:00	02:20 PM	*Effects of an Accretion Disk Wind on the Profile of AGN Emission Lines* (15+5)	Michael Eracleous
08:30 AM - 02:40 PM		Posters	
03:00 - 05:30 PM		Excursion	
06:30 - 10:30 PM		Banquet	

Day 5: Tuesday, October 18, 2011

Session 6: Feedback, Evolution and Galaxy Scale Environments

09:00	09:25 AM	*AGN Winds and the Black-Hole - Galaxy Connection* (20+5)	Andrew King
09:25	09:50 AM	*AGN Feedback: The Key Importance of Momentum Driving (20*+5)	Jeremiah P. Ostriker
09:50	10:10 AM	*The Contribution of HiBALs to AGN Feedback: Results from HST/COS* (20+5)	Nahum Arav
10:15	10:40 AM	*Modeling AGN Outflows: Implications for Feedback Efficiency* (20 + 5)	Claude-Andre Faucher-Giguere
10:40	11:10 AM	Coffee Break	
11:10	11:30 AM	*Gas Accretion onto a Supermassive Black Hole: A Step to Modeling AGN Feedback in Cosmological Simulation* (15+5)	Ken Nagamine
11:30	11:50 AM	*Discovery of Large-Scale AGN Feedback in Merging Galaxies* (15+5)	David Rupke
11:50	12:10 PM	*Black Hole Feedback and the M-sigma Relation in Non-isothermal Galaxies* (15+5)	Rachael McQuillin
12:10	12:30 PM	*Measuring Feedback in Nearby AGN* (15+5)	Michael Crenshaw
12:30 - 01:30 PM		Review/Summary/Discussion	
08:30 AM - 03:00 PM		Posters	

Abstracts, Session 1:
Spectroscopic Observations of AGN Outflows - X-rays and Higher Energies

X-ray Spectral Signatures of Outflows in AGN

Tracey Jane Turner
UMBC

X-ray spectra of AGN are complex. X-ray absorption and emission features trace gas covering a wide range of column densities and ionization states. The absorbing complex shapes the form of the X-ray spectrum, while variations in the line-of-sight gas naturally explain the spectral variability observed. High-resolution spectra show the absorbing gas to be outflowing, perhaps in the form of an accretion disk wind. I discuss recent progress, highlighting some new results and reviewing the implications that can be drawn from the data.

Winds and X-ray Reverberation in AGN

Lance Miller
Oxford University

Type I AGN are highly variable at X-ray energies, and often show times lags between hard and soft energy bands in the range 10s to 1000s of seconds. I discuss how these time lags, their energy dependence and their variability-frequency dependence have a natural explanation as the 'smoking gun' signature of reverberation from circumnuclear material. This is good evidence for a high covering fraction of material, and I place this analysis in the context both of models of winds from the accretion disk and of spectral analyses of these AGN. Results will be presented from some new, long observations with XMM-Newton.

Anatomy of an Outflow: Mapping the Mrk 509 Warm Absorber

Jelle Kaastra
SRON

We present the highlights of a long and deep multi-wavelength campaign on Markarian 509. This campaign consisted of ten regularly spaced, deep 60 ks observations with XMM-Newton, simultaneous with INTEGRAL which were followed by a simultaneous Chandra/LETGS and HST/COS observation, and interspersed with Swift and ground-based X-ray, UV and optical photometry. The time-averaged XMM/RGS spectrum allowed us to dissect the ionisation structure of the outflow, allowing us to make definite statements about the discrete versus continuous nature of the outflow, while the COS data yielded the complex velocity structure. The variability as seen through XMM/EPIC

in specific bands constrains the location and thereby the impact of the outflow.

Abstracts, Session 2:
Spectroscopic Observations of AGN Outflows - Near-UV and Lower Energies

X-ray Evidence for Ultra-fast Outflows in Local AGNs

Francesco Tombesi
NASA/UMD/CRESST

X-ray evidence for massive, highly ionized, ultra-fast outflows (UFOs) has been recently reported in a number of local AGNs through the detection of blue-shifted Fe XXV/XXVI absorption lines. We present the results of a comprehensive spectral analysis of a large sample of 42 local Seyferts and 5 Broad-Line Radio Galaxies observed with XMM-Newton and Suzaku. We assessed the global detection significance of the absorption lines, solving any claimed publication bias, and performed a detailed photo-ionization modeling. We find that UFOs are common phenomena, being present in >40% of the sources. Their outflow velocity distribution spans from 10,000 km/s (~0.03c) up to 100,000 km/s (~0.3c), with peak and mean value at ~40,000 km/s (~0.13c). The ionization parameter is very high, in the range $\log\xi$~3-6 erg s^{-1} cm, with mean $\log\xi$~4.2erg s^{-1} cm. The associated column densities are also large, in the range ~10^{22} - 10^{24} cm^{-2}, with mean ~10^{23} cm^{-2}. Overall, these results point to the presence of extremely ionized and possibly almost Compton thick outflowing material in the innermost regions of AGNs. Their variability and location on sub-pc scales favor a direct association with accretion disk winds/ejecta. This also suggests that UFOs may potentially play a significant role in the AGN cosmological feedback besides jets and their study can provide important clues on the connection between accretion disks, winds and jets.

Energetic Accretion Disk Winds - the case of PDS 456 and PG 1211+143

James Reeves
Keele University, UK

Recent X-ray observations with XMM-Newton, Suzaku and Chandra have revealed the presence of highly ionized outflowing gas in the iron K band in many AGN, which may be associated with a strongly ionized accretion disk wind. Here I review the evidence for such disk winds and in particular discuss the well-studied cases in the QSOs, PG 1211+143 and PDS 456. In PG 1211+143, the wind profile summed over all the XMM observations to date suggests a P Cygni like profile, covering a wide solid angle and with an outflow velocity near 0.1c. I also show that the profile can be well fitted with recent disk wind models. In the high luminosity QSO, PDS 456, the wind is even more

extreme, with an outflow velocity of between 0.25-0.3 c, similar to recent detections of X-ray absorption systems in BAL QSOs. New Suzaku observations of PDS 456 will be presented which show evidence for variations in the absorber parameters, with possible changes in ionization occurring in response to the continuum level. Overall I also review results from recent XMM and Suzaku surveys for iron K absorbers and discuss the likely energetics of these systems.

The Suzaku View of Fe K Band Absorption in AGN

Jason Gofford
Keele University

A recent XMM-Newton study by Tombesi et al. has shown that as many as ~40% of local AGN have very highly ionised H- and He-like Fe absorption at E>6.7keV, with blueshifted velocities which can reach a significant fraction of c. The high ionisation and high velocities imply that the outflowing material originates close to the central black hole, and may represent the signature of a wind launched from the accretion disk. When considering the kinematic of these outflows the mechanical energy is often found to be comparable to the binding energy of a 'typical' 10^11Msun galaxy bulge which suggests that they may be capable of influencing the properties of a host galaxy itself, and possibly leading to the observed M-sigma relation. In this talk I will present the preliminary results of a new broad-band Suzaku study of ~50 archival sources (67 observations) where I have been assessing both how often Fe K absorption is observed and probing the parameters of the absorbing material. I will initially give a brief discussion about the objects which comprise the sample and the analysis methodology employed, before going on to show the most recent results and how they fit in with the existing literature on highly ionised Fe absorption in AGN.

Variable X-ray Absorption in the miniBAL QSO PG 1126-041

Margherita Giustini
INAF/IASF Bologna

X-ray studies of AGN with powerful nuclear winds are important to constrain the physics of the inner accretion/ejection flow around SMBH, and to understand the impact of such winds on the AGN environment. I will present the results of a multi-epoch observational campaign on the mini-BAL QSO PG 1126-041 performed with XMM-Newton from 2004 to 2009. Temporally resolved X-ray spectroscopy and simultaneous UV and X-ray photometry were performed on the most complete set of observations and on the deepest X-ray exposure of a mini-BAL QSO to date. Complex X-ray spectral variability is found on time scales of both months and hours, best reproduced by means of variable massive ionized absorbers along the line of sight. As a consequence, the observed optical-to-X-ray spectral index is found to be variable with time. In the highest signal-to-noise observation, highly ionized X-ray absorbing material outflowing much faster than the UV absorbing one is detected. This highly ionized absorber is found to be variable on very short time scales. The present observational campaign has opened

the time-resolved X-ray spectral analysis field for mini-BAL QSOs. I will discuss the results in the context of accretion disk winds, and introduce future deep studies that will be able to map the dynamics of the inner accretion/ejection flow, understand the physics of AGN winds, and quantify their impact on the environment.

Multi-wavelength Survey of AGN Outflows in a Sample of Local AGNs

Lisa Winter
University of Colorado

While feedback from the central supermassive black hole likely affects the host galaxy evolution in the distant universe, through suppressing star formation, we can not directly observe these processes at work. We can, however, easily observe the host galaxy and AGN properties of nearby sources. To understand the outflow and host galaxy properties in a local sample of AGN, we present our results from optical and X-ray spectroscopic follow-ups of a sample of 50 Seyfert 1s detected in the very hard X-rays (14-195 keV) with the Swift Burst Alert Telescope. Due to the high-energy selection, this survey is largely unbiased to the gas and dust which obscures softer bands. We find that outflows are detected in a majority of the sample and may be present in all local Seyfert 1s. We investigate how these outflows affect their host galaxies through searching for correlations between star formation rate and both accretion rate and outflow strength.

The Chandra Survey of Outflows in AGN with Resolved Spectroscopy (SOARS): Mapping the Kinematics and Geometries of AGN Winds in Seyfert Galaxies

Dan Evans
Harvard-Smithsonian Center for Astrophysics and Elon University

The narrow-line region (NLR) in AGN plays a crucial role in understanding AGN structure and evolution, as well as the interaction between the nuclear engine and the ISM of host galaxies in the form of outflows. Here, we present results from the Chandra SOARS (Survey Outflows in AGN with Resolved Spectroscopy) program, a 1.4 Ms Chandra GO, GTO, and archival study to perform spatially resolved HETG spectroscopy of the kpc-scale NLRs in some of our nearest AGN, including the Circinus Galaxy, NGC 1068, and Mrk 3. We use the sensitive line diagnostics offered by HETG to (1) measure the mass and energy imparted by the AGN outflow into its kpc-scale environment; and (2) create a full kinematic map of the galaxy, thereby directly constraining the extent of the outflow. Our results have key implications for the role of galactic-scale outflows in AGN as moderators of galaxy evolution, and may suggest that outflows have radically different properties in early- and late-type AGN.

A New Model of AGN X-ray-optical SEDs and Their Relevance to Outflows

Martin Ward
Department of Physics, Durham University

We have developed a new energy conserving three component model composed of an accretion disc down to a specific radius, below which the gravitational energy is divided between an optically thick Comptonised disc component, and an optically thin corona above the disc which forms the observed high energy X-ray tail. We find that grouping our sample based on L/Ledd, gives the least dispersion in their averaged SEDs. Previous work has suggested that winds become stronger as L/Ledd increases. However, our results imply an alternative explanation in which the black hole mass, which determines the EUV peak frequency, is more important. Also, the wind may modify the mass accretion rate below the wind launching point, which would require new disc models requiring the accretion rate to vary with radius.

AGN Winds with Athena

Massimo Cappi
INAF/IASF-Bologna

Athena is the new proposal for a large area X-ray telescope with calorimeter-type resolution between 0.1-10 keV, to be launched around 2022. Here I summarize the potential impact of such a mission on studies of AGN winds in nearby and distant galaxies, and stress their importance in the more general context of AGN feedback studies.

Narrow Absorption Line Outflows from Quasars

Fred Hamann
University of Florida

Accretion disk outflows are detected in quasar spectra through a variety of absorption features. Recent studies indicate that narrow absorption line (NAL) outflows, producing line widths FWHM < 500 km/s and often FWHM < 50 km/s, are at least as common as the much more commonly studied broad absorption lines (BALs). Thus the NALs represent an important but still poorly understood aspect of the quasar outflow phenomenon. They span the same range of outflow speeds as BALs, but they are not accompanied by strong X-ray absorption and they are measured across an extremely wide range of distances from the quasars - from a few pc to >100 kpc. One of the greatest challenges for studies of NAL outflows is simply to identify these features amongst the many unrelated (cosmologically intervening) narrow absorption lines that also appear in quasar spectra. We will discuss recent results on the identifications, statistics and physical properties of NAL outflows in quasars.

A Census of Narrow C IV Absorption Lines in Quasars at Redshifts 1.9 < z < 4. 6

Leah Simon
Berea College

We present results from a high-resolution spectroscopic survey of 24 quasars to study the nature and origins of the narrow absorption lines (NALs) that form in quasar environments. We present 271 C IV NAL components in 136 C IV systems in 24 quasars at redshifts $1.94 < z < 4.69$ between the velocity range of $+5000 < v < -40000$ km/s. We determine which components and systems are intrinsic to the quasar environment, that is, which lines form in the host galaxy, from the halo to the center near the quasar itself. Some of these intrinsic NALs have high velocities that limit their origin to quasar outflows. We determine NAL origins by by measuring partial covering in the C IV NALs and by looking for very broad and smooth NAL profiles. Several high-velocity, narrow outflows also appear in our sample. Approximately 46% of the quasars in our sample contain at least one intrinsic NAL, with only ~30% containing an intrinsic NAL within 5000 km/s of the quasar redshift. Several rich and complex C IV NAL systems are present, suggesting that the phenomenon of quasar outflows is a complex process.

Exploring Micro-Turbulence in Intrinsic UV Absorbers

Steve Kraemer
Catholic University of America

Heavily saturated UV absorption lines, such as those detected in BAL QSO's and a few Seyfert 1s, are typically quite broad. This can be due to superposition of many individual components, i.e. velocity gradients, or the domination of the profiles by the damped wings, i.e., a 'walking wall' effect. Nevertheless, even the weakest UV absorption lines detected in Seyfert 1s have widths that are significantly greater than thermal. Interestingly, the smoothness of broad emission line profiles and under-predictions of the strengths of BLR lines and coronal NLR lines by photo-ionization models suggest the importance of micro-turbulence and associated dissipative heating within the emission-line gas. Hence, it is also possible that turbulence is important for the absorbers. We will discuss the evidence for turbulence and its possible role in the structure of gas in the proximity of an AGN.

Reorienting Our Perspective of Broad Absorption Line Quasars

Michael DiPompeo
University of Wyoming

New radio continuum and optical spectropolarimetric observations of a large number of radio-selected BAL quasars will be presented, which do indicate a range of orientations but a clear preference compared to normal quasars. I will also present results on the relationship between orientation and optical polarization. Our data indicate complexity and suggest that while orientation plays an important role, it is not the only factor determining the presence of BALs or their range of observed properties.

Abstracts, Session 3:
Spectroscopic Observations of AGN Outflows - Near-UV and Lower Energies

CIV Emission as a Probe of Accretion Disk Winds

Gordon Richards
Drexel University

I discuss our recent work using the CIV emission line to investigate accretion disk winds in quasars. We have found that a combination of the CIV EQW and CIV blueshift defines a sequence that can be used as a diagnostic of the relative contribution of disk and wind contributions to the BELR. It appears that disk-dominated sources have 'hard' SEDs, while wind-dominated sources have 'soft' SEDs. These SED differences may underlie the more general 'Eigenvector 1' correlates. Understanding the differences in the BELR across this parameter space has important implications for our understanding of bolometric luminosities, accretion rates, and black hole masses in individual quasars (as compared to the ensemble average).

Probing High-column Outflows in BALQSOs Using Metastable Helium

Karen Leighly
The University of Oklahoma

Outflows are believed to be ubiquitous in active galaxies. They are most readily recognized as blueshifted absorption lines in the rest-UV spectra of 10-40% of quasars. Outflows are likely to be an essential part of the AGN phenomenon, carrying away angular momentum and so facilitating accretion, distributing chemically-enriched gas through the intergalactic medium, and contributing to the coevolution of black holes and galaxies through feedback. Despite their importance, the acceleration mechanism of outflows remains unknown. Several models have been proposed, but their parameters remain unconstrained due to difficulties in measuring the physical parameters of the outflows. It is especially difficult to constrain the column density since most of the lines are saturated. However, column densities can be measured using ions that are expected to be relatively rare in the gas, since they are least likely to be saturated. Phosphorus, specifically the PV doublet at 1118 and 1128 \AA, is generally regarded as a useful probe of high column densities because of its low abundance. We have found that the metastable neutral Helium triplet provides an equally valuable probe of high column densities in BALQSOs. The metastable state has a lifetime of 2.2 hours, is populated by recombination of He+, and can act as a second ground state in neutral helium. It can easily be shown, both analytically and through photoionization modeling, that HeI* is just as sensitive PV to high column densities. The significant advantage is that it can be observed in the infrared (HeI*λ 10830) and the optical (HeI* λ 3888)

bands. Furthermore, these two transitions have the same lower level, so covering fraction and true optical depth measurements can be made. We report the discovery of the first HeI*λ 10830 BALQSO FBQS J1151+3822, and discuss constraints on the column density and covering fraction obtained from the optical and IR HeI* lines. In addition, we describe additional constraints obtained from new observations of MgII absorption in this object. Finally, we introduce two follow-up projects that will be described further in a poster.

BAL Quasars with Redshifted Absorption

Patrick Hall
York University, Toronto, Canada

The SDSS-III Baryon Oscillation Spectroscopic Survey (BOSS) has discovered a number of broad absorption line quasars with high-ionization troughs extending to redshifted velocities (relative to the quasar rest frame) of up to v=9000 km/s. Contaminating absorption from unrelated transitions is unlikely, and is ruled out in some cases by redshifted absorption in multiple lines. Multiple potentially viable origins for redshifted absorption may be at work: infall (for low-velocity systems), unresolved binary quasars with at least one member a broad absorption quasar, rotationally dominated outflows silhouetted against a quasar's extended continuum source, and the relativistic Doppler effect in gas moving at high velocity close to transverse to our line of sight.

The Multiwavelength Campaign on Mkn 509: Characterizing the UV and X-ray Outflow

Gerard Kriss
Space Telescope Science Institute

We observed Mrk 509 during the fall of 2009 during a multiwavelength campaign using XMM-Newton, Chandra, HST/COS, SWIFT, and Integral. The 600-ks XMM/RGS spectrum finds two kinematic components and a discrete distribution of ionized absorbers. Our high S/N COS spectrum detects additional complexity in the known UV absorption troughs from a variety of sources in Mrk 509, including the outflow from the active nucleus, the ISM and halo of the host galaxy, and infalling clouds or stripped gas from a merger that are illuminated by the AGN. The UV absorption only partially covers the emission from the AGN nucleus with covering fractions lower than those previously seen with STIS, and are comparable to those seen with FUSE. Given the larger apertures of COS and FUSE compared to STIS, we favor scattered light from an extended region near the AGN as the explanation for the partial covering. As observed in prior X-ray and UV spectra, the UV absorption has velocities comparable to the X-ray absorption, but the bulk of the ultraviolet absorption is in a lower ionization state with lower total column density than the gas responsible for the X-ray absorption. Variability compared to prior UV spectra lets us set limits on the location, density, mass flux, and kinetic energy of the outflowing gas.

Broad Absorption Line Variability on Multi-Year Timescales: Current Results and Future SDSS-III Prospects

Niel Brandt
Penn State University

Over the past few years, we have been studying the variability of Broad Absorption Lines (BALs) on multi-year rest-frame timescales using historical spectroscopy from the LBQS and Palomar combined with new spectra from the SDSS and the Hobby-Eberly Telescope (sample sizes of 10-15 BAL quasars). This talk will describe some of our main findings including (1) quantification of how BAL variability increases with rest-frame timescale, (2) characterization of the basic modes of multi-year BAL variability; e.g., variation often occurs in discrete regions which are only a few thousand km/s wide, (3) tight limits upon BAL acceleration enabled by the long sampled timescales, and (4) the resulting physical constraints upon BAL lifetimes and wind models. We will also present first results from an SDSS-III BOSS ancillary project aiming to transform the field of multi-year BAL variability studies into one that supplies rigorous large-sample constraints upon quasar winds. BOSS is re-observing 2000 bright BAL quasars observed by SDSS-I/SDSS-II from 2000-2008. This sample size is ~ 100 times larger than those of current multi-year BAL studies, and > 650 objects are already observed. Measured variations constrain, e.g., BAL disappearance and emergence, BAL lifetimes, the modes of multi-year BAL variability, and BAL acceleration. For example, we have already detected > 15 new examples of BAL disappearance events. Soon we will constrain the dependence of multi-year BAL variability upon luminosity, redshift, black-hole mass, Eddington fraction, and radio properties.

Variability in Quasar Broad Absorption Line Outflows

Daniel Capellupo
University of Florida

Broad absorption lines (BALs) in quasar spectra identify high velocity outflows that likely exist in all quasars and could play a major role in feedback to galaxy evolution. Studying the variability in these BALs can help us understand the structure, evolution, and basic physical properties of these outflows. We are conducting a BAL monitoring program, which so far includes 163 spectra of 24 luminous quasars at z=1.2-2.9, covering time-scales from ~1 week to 8 years in the quasar rest-frame. We investigate changes in both the CIV 1550 BALs and the SiIV 1400 BALs, and we see a variety of phenomena, including some BALs with dramatic variability over a wide range in outflow velocities and other BALs that did not change at all over the entire observation period. Variability generally occurred in only portions of BAL troughs. The fraction of quasars with CIV BAL variability increased as we added more observing epochs to our sample, and we found that 88% of the quasars had CIV BALs that varied. When comparing CIV to SiIV BAL variability, we found that SiIV BALs are more likely to vary than CIV BALs. When both the CIV and SiIV BALs vary within the same quasar, they always vary in the same

sense (with both lines either getting stronger or weaker). We have new data that probe the shortest time-scales (<1 month rest-frame), in order to determine the minimum time-scale over which variability is detected. This will provide constraints on the location of the outflowing gas. We also present some preliminary results on the study of certain key diagnostic lines, such as OVI 1032, 1038 and PV 1118, 1128. Studying these lines will provide crucial constraints on the total column densities in the flows, which we can then use to estimate their mass outflow rates and kinetic energy yields. These quantities will help determine the viability of these outflows as a feedback mechanism.

Variability of mini-BAL and BAL outflows in quasars

Paola Rodriguez Hidalgo
Penn State University

We report the results of a monitoring program of the variability of high-velocity (up to 0.2c) mini-BALs and BALs in quasar spectra designed to better characterize the structural and physical properties of these outflows. The program covers a range of 0.9-3.3 years in the quasars' rest-frame by comparing new spectra (using facilities at the Kitt Peak National Observatory and MDM Observatory) with archival spectra (obtained from the SDSS). We find that ~50% of quasars with mini-BALs and BALs at high velocity varied between just two observations. This variability tends to occur in complex ways; however, all the variable lines vary in intensity and not in velocity, not finding evidence for acceleration/deceleration in these outflows. Due to the variations in strength, mini-BALs can become BALs and viceversa, suggesting a similar nature of these two classes of absorbers.

Abstracts, Session 4:
Imaging and Spatially Resolved Spectroscopy of AGN Winds

Outflows in Nearby AGN from Integral Field Spectroscopy

Thaisa Storchi Bergmann
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I will discuss recent kinematic studies of the Narrow-Line Region (NLR) of nearby Active Galactic Nuclei (AGN) from observations obtained with optical and near-IR Integral Field Spectrographs at the Gemini Telescopes. The ionized gas kinematics usually shows a combination of rotational motion and outflow. The flux distribution and outflow kinematics correlate with structures seen in radio maps, but in some cases the orientation of the two -- optical and radio outflows -- differ by up to a few tens of degrees. Outflow velocities range from a few to several hundreds of km/s, and the mass outflow rates from 0.01 to a few solar masses per year. These rates are 1 to 3 orders of magnitude larger than the mass accretion rate to the AGN and its origin is thus entrainment of host galaxy gas by the AGN outflow (accretion disk wind or radio jet).

From the measured velocities and mass outflow rates we estimate the kinetic power of the outflow, which is usually smaller than 1 percent of the bolometric luminosity of the AGN. Centroid velocities obtained from the fit of the emission-line profiles suggest outward acceleration along the NLR within the inner few tens of pc, but channel maps show, on the other hand, higher velocities close to the nucleus and smaller velocities outwards.

Diffraction-Limited Integral-Field Spectroscopy of Outflows from AGN

Francisco Muller-Sanchez
Instituto de Astrofisica de Canarias

We present results of an ongoing program to study AGN outflows using integral field spectroscopy and adaptive optics at Keck Observatory and VLT. The observations reveal kinematic signatures of rotation and outflow in the Narrow-Line and Coronal-Line Regions of nearby AGN. The spatially resolved kinematics can be modeled as a combination of an outflow bicone and a rotating disk coincident with the molecular gas. High-excitation emission is seen in both components, suggesting it is leaking out of a clumpy torus. While NGC 1068 (Seyfert 2) is viewed nearly edge-on, intermediate-type Seyferts are viewed at intermediate angles, consistent with unified schemes. A correlation between the outflow velocity and the molecular gas mass in $r < 30$ pc indicates that the accumulation of gas around the AGN increases the collimation and velocity of the outflow. The outflow rate is 2–3 orders of magnitude greater than the accretion rate, implying that the outflow is mass loaded by the surrounding interstellar medium (ISM). In half of the observed AGNs, the kinetic power of the outflow is of the order of the power required by two-stage feedback models to be thermally coupled to the ISM and match the M–sigma relation. In these objects, the radio jet is clearly interacting with the ISM, indicative of a link between jet power and outflow power.

High-ionization Gas in Active Galactic Nuclei: Line Profiles and Physical Conditions

Alberto Rodríguez Ardila
Laboratório Nacional de Astrofísica

Mid- and high-resolution SOAR/Goodman spectroscopy is employed to detect the coronal lines [FeVII] 3759, 5159, 6087 Å, [NeV] 3423 Å and [FeX] 6083 Å, the former three suitable to determine the temperature and density of the high-ionization gas. The high resolution spectra allow us to characterize the profiles of [FeVII] 6087 Å and [FeX] 6374 Å using information such as asymmetries, shifts from the centroid position and line width. The combined results (physical properties of the coronal line region and line profile characterization) allow us to detect signatures of outflows in the coronal gas and thus set up constrains on the origin of the CLs in AGNs. In addition, AO GEMINI/NIFS J and K-band spectroscopy is used to study the coronal gas morphology at spatial scales of a few parsecs in the Seyfert 2 galaxy NGC 1068. We found that the gas distribution is rather inhomogeneous and asymmetric. From the comparison of the high-ionization

emission ([SiVI], [SIX], [CaVIII] and [MgVII]) with the Merlin 6cm radio emission we found evidence that the CL gas kinematics and morphology is strongly related to the radio jet morphology. Moreover, NIR emission line flux ratios give additional support to the presence of shocks produced by the interaction between the jet and the circumnuclear gas. All above results allow us to confirm the role that coronal lines have to trace outflows at the inner tens of parsecs of AGNs.

Massive Neutral and Molecular Winds in Nearby Galaxies

Sylvain Veilleux
University of Maryland

In the past year, our team has had three major scientific breakthroughs: (1) Our Herschel PACS GTO survey of ULIRGs (SHINING) has revealed far-infrared (FIR) OH features with P-Cygni profiles indicative of massive molecular outflows in several ULIRGs, including the closest quasar known, Mrk 231. (2) Independent, spatially resolved CO-emission observations of Mrk 231 with the IRAM/PdB mm-wave interferometer have confirmed this outflow and deduced mass outflow rates of about 700 M_sun yr^{-1}, far larger than the on-going SFR (~200 M_sun yr^{-1}) in the host galaxy. Remarkably, this CO outflow coincides spatially with blueshifted optical Na ID 5890, 5896 A absorption features detected ~2-3 kpc from the nucleus. (3) Our recent Gemini/IFU observations have revealed that the Na ID outflow is wide-angle, thus driven by a QSO wind rather than a jet. This powerful outflow may be the long-sought ``smoking gun' of quasar mechanical feedback that clears out the molecular disk formed from dissipative collapse during the merger. I will discuss how our group is actively following up on these exciting new results.

Evidence for Termination of Obscured Starbursts by Radiatively Driven Outflows in Reddened QSOs

Duncan Farrah
University of Sussex

We present mid to far-infrared photometry of 31 reddened QSOs that show evidence for 'quasar mode' AGN outflows in their rest-frame UV spectra. We combine these observations with archival optical through near-infrared photometry and radiative transfer models to study the relationship between obscured star formation and radiatively driven outflows in reddened QSOs. Our sample are invariably IR-luminous, with IR luminosities exceeding $10^{12}L\odot$ in all cases. The AGN supplies 75% of the total IR emission, on average, but ranges from 20% to 100%. Starburst emission is more luminous than $10^{12}L\odot$ in about one third of the sample, and is brighter than the AGN in ~13% of the sample. We find a strong anticorrelation between the strength of the outflows seen in the rest-frame UV, and the contribution from starburst emission to the total IR luminosity, with a higher chance of seeing a starburst contribution in excess of 25% in systems with weak outflows compared to systems with strong outflows. We conclude that radiatively driven outflows from an AGN act to curtail star formation in the

host galaxies of reddened QSOs, and that this effect is relative; outflows act to reduce the contribution from star formation to the total IR luminosity to less than ~25%, but do not primarily affect the absolute luminosity of the starburst. Finally, we find only weak evidence that the strength of the outflows depends on the IR luminosity of the AGN, and so propose, albeit tentatively, that the degree to which termination of starburst activity is taking place is not reflected in the IR luminosity of the AGN.

AGN Narrow-Line Kinematics: Determining Inclinations Via Outflows

Travis C. Fischer
Georgia State University

We present work on the narrow-line region (NLR) kinematics in a sample of AGN using HST STIS long-slit spectra. We apply simple biconical outflow models to those exhibiting kinematics dominated by radial outflow, which can be used to determine the inclination of the bicone axis, and hence the obscuring torus, with respect to our line of sight. We investigate the dependence of observed properties of AGN (e.g., spectral-energy distributions, absorbing columns, broad-line widths) on polar angle, which is vital for understanding the physics of AGN.

Lower Limits on the Metallicity of SDSS BALQ Outflows

Alexei Baskin
Technion - Israel Institute of Technology

There is growing evidence for gas metallicity higher than solar in various nuclear regions in AGN. Absorption lines, in particular broad absorption lines, can serve as more robust estimator of the gas metallicity, as they constrain directly the absorbing gas ionic column densities. We discuss a physical mechanism, related to radiation pressure, which can produce a highly metal-enriched outflow. We then present a method for setting a robust and direct lower limit on the outflow metallicity, based on the observed metals and Hydrogen columns. We analyze several carefully selected BALQs from the SDSS database as test-case objects for this method. We find evidence for a super-solar metallicity, 10-time or higher, for a number of them.

The Lick AGN Monitoring Project 2011: Dynamical Modeling of High-quality Reverberation Mapping Data

Anna Pancoast
University of California at Santa Barbara

We present preliminary results from the Lick AGN Monitoring Project Spring 2011 (LAMP 2011) reverberation mapping campaign. The sample consists of AGNs with spectral coverage from 3440-5520 Angstroms in the visible and continuum photometry coverage in the V-band. The main goals of the program are to obtain velocity resolved

reverberation mapping data and to constrain the kinematics and geometry of the broad line region and determine the mass of the black holes. For this purpose, in addition to applying the traditional reverberation mapping analysis, we have developed a new framework to model the reverberation mapping data directly using geometric and dynamical models. I will show first results from LAMP 2011, obtained for Mrk 50, one of the most variable objects in the sample. Modeling the reverberation mapping data allows us to estimate the black hole mass in Mrk 50 without a normalizing constant, as is needed for traditional reverberation mapping analysis. Our modeling constrains the geometry of the BLR, including its distance from the central source, its width, and its inclination with respect to the line of sight. The model also includes a simple prescription for net inflowing and outflowing gas in the BLR. While our model for the geometry and dynamics is relatively simple, it is able to model broad spectral line asymmetries and could be expanded to include more complicated models in the future. The LAMP 2011 data set should allow us to explore the differences between the geometry and inflow/outflow properties in different Seyfert 1 galaxies, and provide an independently-calibrated set of AGN black hole masses to use in the M-sigma* relation.

Abstracts, Session 5:
Simulations and Energetics of AGN Winds

Simulations of AGN Winds

Daniel Proga
University of Nevada, Las Vegas

I review the results from multi-dimensional, time-dependent simulations of gas dynamics in AGN. I will focus on two types of winds powered by radiation emitted from the AGN central engine: (i) winds driven from the innermost part of an accretion disk and (2) winds driven from a large-scale inflow that is likely the main supplier of material to the central engine. I discuss the relevance of both types of winds to the so-called AGN feedback problem. However, the AGN feedback should not be considered separately from the AGN physics. Therefore, I also discuss the issue whether the properties of the same winds are consistent with the gas properties in broad- and narrow-line regions of AGN.

Radiation-MHD Simulations of Black Hole Accretion Flows and Outflows

Ken Ohsuga
National Astronomical Observatory of Japan

By performing global radiation-MHD simulations of black hole accretion flows and outflows, we found that jets and low-velocity outflows are ejected from the accretion disks. The low-velocity outflows consist of a number of gas clouds and exhibit time-

depnedent behavior. The opening angle of this outflow is around 50 degree. The obscuration by the outflows could explain absorbing features of AGNs in X-ray and UV band. The jets, of which speed is several 10% of the light velocity, are radiatively accelerated and magnetically collimated. This type of jet may explain relativistic jets from the luminous AGNs/quasars.

Time Dependent Photoionization of AGN Outflows

Manuel A Bautista
Dept. of Physics, Western Michigan University

Photoionized gas outflows are fundamental components of Active Galactic Nuclei (AGN). In these outflows, time-variability of ionizing radiation, which is characteristic of AGN in various different time scales, may produce non-equilibrium photoionization conditions over a significant fraction of the flow and yield supersonically moving cooling/heating fronts. These fast fronts create pressure imbalances that significantly affect the structure and kinematics of the flow. We are studying such effects theoretically by constructing time-dependent photoionization and radiative-hydrodinamic models. Here, we report early results of this investigation, pertaining a wide range of flow physical conditions.

AGN Structure and the 3 Forms of Radiation Driving

Martin Elvis
Harvard-Smithsonian Center for Astrophysics

Observations point to material being thrown off quasar accretion disks over a wide range of radii. Under the right conditions, this material can be accelerated, sometime to escape velocity (Risaliti G., and Elvis M., 2010A&A...516A..89R). The zones where material forms winds that can be identified with observed features, and where the material does not escape, other features should be formed and these too are observed (e.g. Maiolino et al. 2010A&A...517A..47M). The result is a simple physical picture that seems to combine most of the emission and absorption phenomena of AGNs.

A Radiative Transfer Code for Modelling (BAL)QSOs

Nick Higginbottom
Southampton University

Broad absorption line quasars (BALQSOs) are a class of QSOs exhibiting broad, blue-shifted ultraviolet (UV) absorption lines. These lines are thought to be formed in fast and powerful accretion disk winds, but the geometry and kinematics of these outflows are not well understood. In fact, even the wind driving mechanism remains controversial, as is their relevance to galaxy formation and evolution via the mass, energy and momentum they feed back into their environments. In order to shed light on these issues, we are using a 3-D Monte Carlo ionization and radiative transfer code to

generate synthetic UV spectra for a wide variety of disk wind models and quasar SEDs. The resulting UV spectra and BAL profiles can be directly compared to observations, yielding an empirically constrained physical picture of quasar outflows. In the longer term, our goal is to model not just BALQSOs, but to use our code to test geometric AGN unification models more generally.

Looking for the Wind in the Dust

Sarah Gallagher
The University of Western Ontario

Wind signatures in the UV spectra of populations of quasars are well documented. In particular, the blue-shifted broad emission lines and/or broad absorption lines seen in many luminous quasars are striking evidence for a broad-line region in which radiation driving plays an important role. We consider the case for a similar role for radiation driving beyond the dust sublimation radius by focussing on the infrared. There, the relationship between luminosity and the prominence of the 3-5 micron bump may be key. To investigate this further, we apply the 3D magnetohydrodynamic wind model of Everett (2005) to predict the infrared spectral energy distributions of quasars. The presence of the 3-5 micron bump and strong, broad silicate features can be reproduced with this dynamical wind model when radiation driving is taken into account.

Anisotropic Dust-driven Winds Simulated Using Monte Carolo Radiative Transport

Nathaniel Roth
UC Berkeley

We use Monte Carlo radiative transfer to construct a simulated snapshot of the radiation pressure tensor in dusty gas residing within a radius of approximately 10 parsecs from an accreting super-massive black hole. Our snapshot corresponds to the moment that the black hole enters an epoch of accretion after a large amount of gas has been drawn in to the galactic nucleus (e.g. after a major merger). We calculate the amount of momentum deposited and the expected mass-loss rate in the resulting wind as a function of solid angle. We also consider the effects of varying the black hole luminosity, the dust content of the surrounding gas, and the spatial configuration of the gas. The ~10 pc scale is where the accretion rate onto the black hole is set hydrodynamically, and so this is a scale of great interest when considering the effect of radiation feedback on AGN luminosity. This is also the scale where the observed 'dusty torus' is presumed to reside based on observations of less obscured AGN, and so we may provide insight on how this configuration is reached.

X-ray Signatures of AGN Outflows: Multi-dimensional Radiative Transfer Simulations

Stuart Sim
RSAA, ANU

Outflows have been proposed to explain a variety of features in the X-ray and UV spectra of AGN. The origin and launching mechanism for such outflows remains unclear but they may be associated with winds blown off the accretion flow/accretion disc. In general, such winds are not spherically symmetric and they can affect observed spectra in a variety of ways that depend on the observer inclination. I will discuss results of theoretical multi-dimensional radiative transfer simulations that provide detailed synthetic spectra for plausible wind geometries. These illustrate both the range of spectral signatures that winds can produce and, moreover, guide the interpretation of observations in the context of wind models. I will discuss both the absorption features (including highly blue-shifted absorption lines) and broad emission features that are predicted in the wind models.

MHD Winds as X-ray/UV absorbers in AGN

Demos Kazanas
NASA/GSFC

We show that a broad class of MHD winds off accretion disks have properties consistent with those of so called 'warm absorbers'. We present the ionization structure of these winds and show how besides the X-ray absorber properties they address the also issue of AGN unification. These winds provide a 2 parameter family of models with mdot and the inclination angle as the parameters that set the AGN appearance. Additional dependence comes from the parameter a_ox of the AGN which however is not independent of their absolute luminosity. This classification scheme can account for the general properties of ionization structure of accretion powered sources from those of stellar mass to the brightest quasars.

A Global View of AGN Ionized Winds

Keigo Fukumura
UMBC/CRESST/NASA

From the extensive spectroscopic observations of AGNs the robust features of absorption lines (e.g. most notably by highly-ionized oxygen and iron) have been detected in soft X-rays (aka. warm absorbers). The identified line energies are often mildly blueshifted to yield line-of-sight (LoS) velocities up to ~100-3,000 km/sec in typical X-ray-bright Seyfert 1 AGNs. The state-of-the-art X-ray data obtained with NASA's Chandra/XMM-Newton/Suzaku observatories have recently revealed from a number of AGNs that these ions have almost a constant column density over ~4 decades in ionization parameter suggesting an n~1/r density profile of ionized plasma along LoS distance from the central engine (e.g. MCG-6-30-15, NGC 3783, NGC 7469,

IRAS 13349+2438). In addition a population of AGNs (e.g. X-ray-faint Seyferts and optically-bright quasars; PG 1115+080, PDS 456, APM 08279+5255) exhibits even faster outflows of highly-ionized iron (v/c ~ 0.3-0.7). I will discuss these data in the context of a global MHD accretion-disk wind model searching for a defining parameter to characterize a global property of these ionized outflows.

Effects of an Accretion Disk Wind on the Profile of AGN Emission Lines

Michael Eracleous
Penn State University

We explore the connection between AGNs with single- and double-peaked broad emission lines by using models that deal with the effects of radiative transfer through a disk wind. We build upon the analytical model of Murray & Chiang (1997) and Chiang & Murray (1996) by including general relativistic effects and a direct integration method. We explore a wide parameter space of the disk-wind model and find that the profiles of the broad Balmer lines are affected significantly by the optical depth over the lineemitting region of the disk. As the optical depth through the outwardly accelerating skin of the disk (the base of the wind) increases, the two peaks of a double-peaked profile move closer and eventually merge, producing a single-peaked line profile. We also find that the properties of the emission line profile depends more sensitively on the geometric parameters of the line-emitting portion of the disk and less on the disk-wind parameters. Using a parameter range that encompasses the expected characteristics of the broad line regions in AGNs, we construct a database of model profiles and measure from them a set of diagnostic properties (such as the width, shift, asymmetry, and kurtosis). We compare observed emission line profiles from spectra of a subset of SDSS quasars with the model profiles and find that they are consistent with moderately large optical depth and a narrow range of disk inclinations less than about 45 degrees.

Abstracts, Session 6:
Feedback, Evolution and Galaxy Scale Environments

AGN Winds and the Black-Hole - Galaxy Connection

Andrew King
Dept of Physics and Astronomy, Univ. of Leicester, UK

AGN winds give direct evidence of how supermassive black holes (SMBH) affect their host galaxies. The winds communicate significant fractions of the holes' binding energies to their hosts, leading directly to the M - sigma relation. and probably to the black hole - bulge mass relation. The physical connection between wind and host occurs in a shock, which is strongly cooled if it is close to the SMBH, leading to a momentum-driven outflow of the host interstellar medium. There is good evidence that X-ray-detected outflows interact with the host in this way. If the shock is able to escape to larger radii, cooling is weak and the shock becomes an energy-driven outflow of the host ISM. This is probably the origin of massive large-scale outflows detected in molecular lines. X-ray outflows appear to be present in a large fraction of local AGN, and I comment on the possible implications of this.

AGN Feedback: The Key Importance of Momentum Driving

Jeremiah P. Ostriker
Princeton University

The Contribution of HiBALs to AGN Feedback: Results from HST/COS

Nahum Arav
Virginia Tech

HST/COS data allow us to obtain the first distance determination for a high ionization UV outflow, and to measure the column density in it's hot (warm absorber) phase. Combined with the assertion that this is a typical high ionization outflow, which is detected in more than 20% of all quasars, we can determine robust values for the mass flux (300 solar masses per year) and kinetic luminosity (2% of the quasar's bolometric luminosity) of the outflow. Such large kinetic luminosity and mass flux values, measured in a typical high ionization wind, suggest that quasar outflows are a major contributor to AGN feedback mechanisms.

Modeling AGN Outflows: Implications for Feedback Efficiency

Claude-Andre Faucher-Giguere
UC Berkeley

Feedback from active galactic nuclei is believed to produce the observed correlations between the spheroid components of galaxies and their central supermassive black holes, as well as to play a key role in establishing the red sequence. How the energy and momentum from black holes couples to the interstellar medium however remains an open question. I will describe new physical models of AGN outflows, specifically those recently studied via low-ionization broad absorption lines and in molecular emission. I will show how the physical models allow us to interpret the observations more accurately, and to derive more robust constraints on the efficiency of galactic feedback.

Gas Accretion onto a Supermassive Black Hole: A Step to Modeling AGN Feedback in Cosmological Simulation

Ken Nagamine
University of Nevada, Las Vegas

There are abundant evidence that AGN feedback is important for quenching star formation in massive galaxies at intermediate redshifts, causing them to evolve passively during z~2 to z=0. Several cosmological simulations have attempted to model the growth of supermassive black holes (SMBH) and its feedback effects, however, the prescriptions adopted so far for gas accretion onto SMBHs are still very ad hoc and crude due to limited resolution. Here we take an alternative approach, and attempt to simulate the gas accretion onto SMBH directly at a small scale of <100 pc using the same GADGET SPH code used for cosmological hydrodynamic simulations. We start with the simplest spherical Bondi accretion, and gradually add more complex physics such as radiative heating and cooling by X-rays. The initial phase of our study shows that the code can simulate the Bondi accretion for a limited time, with some caveats on the boundary condition treatment. The inclusion of radiative heating and cooling seems to trigger thermal instability in the inflowing and outflowing gas, and the gas starts to fragment into filaments and clumps, and hot gas tries to escape in the form of buoyant bubble and chimneys. We discuss the disparity between our results and the current implementation of AGN feedback by other researchers.

Discovery of Large-Scale AGN Feedback in Merging Galaxies

David Rupke
Rhodes College

I will present spatially-resolved observations of newly-discovered, kiloparsec-scale AGN outflows, driven not by radio jets but instead through AGN energy distributed over wide angles. By studying nearby galaxies that host AGN, and harnessing the power of modern optical integral field units, it is possible to probe wide angle outflows driven by

AGN over large scales and assess their impact on their host galaxies. Such studies are highly complementary to single-aperture spectroscopic campaigns of AGN flows. In particular, I will focus on the stage when powerful QSOs are emerging from dust-enshrouded cocoons in the late stages of major mergers.

Black Hole Feedback and the M-sigma Relation in Non-isothermal Galaxies

Rachael McQuillin
Keele University

It has been shown by several authors that the M-sigma relation between supermassive black hole (SMBH) mass and velocity dispersion of the host galaxy bulge, sigma, can be understood as a consequence of momentum-conserving feedback from the SMBH. Such feedback sweeps the surrounding ambient medium into a shell that expands out into the galaxy. If the shell escapes, the growth of the SMBH and galaxy-wide star formation is cut off and the M-sigma dependence is locked in. Previous treatments of this problem have assumed outflows into galaxies modelled as singular isothermal spheres and have focused on the behaviour of the shell only very near or very far from the SMBH. We present a consolidated analysis of the problem in the isothermal case, and we extend this work to include more realistic cases in which the dark matter halo need not be a singular isothermal sphere, and the gas in the galaxy need not trace the dark matter distribution. With these considerations, we explore a more detailed parameter space influencing the M-sigma and related scalings.

Measuring Feedback in Nearby AGN

D. Michael Crenshaw
Georgia State University

I present measurements of mass outflow rates and kinetic luminosities for outflows seen in absorption and/or emission in a sample of nearby AGN. Mass outflow rates from UV and X-ray absorbers often exceed accretion rates by an order of magnitude or more, indicating that most of the incoming fuel gets blown away before it reaches the inner accretion disk. Kinetic luminosities of the outflowing absorbers can be as large as 5% of the bolometric luminosities, which suggests they have a significant impact on their environment. Mass outflow rates and kinetic luminosities of the emission-line gas in the narrow-line regions of these AGN tend to be even greater than those of the absorbers, providing evidence for in situ acceleration of the gas and significant feedback on scales of hundreds of parsecs.

POSTERS

1.1 ***Chandra HETGS Observation of Ark564: X-ray View of AGN Outflows***
Anjali Gupta
Ohio State University

We present the results of our preliminary analysis of the Chandra High Energy Grating Spectrometer (HETGS) spectra of the Narrow-line Seyfert 1 Galaxy Ark564. A broad range of absorption lines intrinsic to the system are seen against the strong soft continum. The spectral modeling is performed using a code PHASE (Photoionized Absorber Spectral Engine) that self-consistently reproduces the X-ray absorption spectrum of an absorber intrinsic to the system. We identify two distinct absorption components: one with alow ionization parameter (LIP) and the other with a high ionization parameter (HIP). We will also discuss the physical conditions of warm absorber in the Ark564.

1.2 ***Extreme Wind-Dominated Broad Emission-Line Regions in a Class of X-ray Weak Quasars***
Jianfeng Wu
Penn State University

Luminous X-ray emission is considered to be a universal property of efficiently accreting supermassive black holes. However, we have identified a population of X-ray weak type 1 quasars in the Sloan Digital Sky Survey at high redshift (Wu et al. 2011, ApJ, 736, 28). These quasars were selected to have unusual UV emission-line properties (weak and blueshifted high-ionization lines; strong UV Fe emission) similar to those of the remarkable low-redshift quasar PHL 1811. All radio-quiet PHL 1811 analogs are notably X-ray weak by a mean factor of ~13. The average X-ray spectrum of these PHL 1811 analogs appears to be harder than those of typical quasars, indicating the possible presence of intrinsic X-ray absorption. Correlations between the X-ray weakness and UV emission-line properties suggest that PHL 1811 analogs have extreme wind-dominated broad emission-line regions (BELRs). These sources may have high-ionization 'shielding gas' with a large column density and a large covering factor of the BELR. The shielding gas absorbs most of the X-ray and ionizing photons, resulting in strong wind acceleration in the BELR and weak and blueshifted broad emission lines. This model has the advantage of potentially unifying the PHL 1811 analogs with the general population of weak-line quasars.

1.3 ***Winds in Mrk 509: A Common Origin for the X-ray and UV Ionized Gas***
Jacobo Ebrero
SRON - Netherlands Institute for Space Research

The majority of local unabsorbed active galaxies show evidence of non-relativistic ionized winds in their nucleus, the so-called warm absorber (WA). They are seen as absorption troughs in the soft X-ray spectra of these galaxies, usually blueshifted by hundreds of km/s with respect to the systemic velocity of the source and thus outflowing from the nucleus. Many of these AGN also show evidence of ionized gas in their UV spectra. The question of whether the UV and X-ray absorbers share a common origin is a hot topic in modern extragalactic astronomy and may have profound implications for the unification models of AGN and cosmic feedback processes. We used high-resolution high signal-to-noise X-ray and UV spectra to disentangle the origin of these absorbers in the Seyfert 1 galaxy Mrk 509. The data consisted of 600 ks with XMM-Newton RGS, and 180 ks with Chandra LETGS simultaneous with HST-COS observations, and were part of an extensive multiwavelength campaign on Mrk 509. The analysis of the spectra reveals the presence of several kinematic components in the ionized gas, up to 6 in X-rays and 13 in the UV. At least three of the X-ray components can be kinematically associated with the observed UV components, which points to a possible co-location of both absorbers. Using the ionic column densities measured by HST-COS and past FUSE observations, we find evidence that the gas responsible for the UV and X-ray absorption share a common origin. The gas likely resides in high-density low-ionization clouds, responsible for the UV absorption, embedded in a less dense highly ionized wind responsible for the X-ray absorption.

1.4 ***A Study Of The X-Rayed Outflow Of Apm 08279+5255 Through Photoionization Codes***

Cristian Saez
Penn State University

We present new results from our study of the X-rayed outflow of the z=3.91 gravitationally lensed broad absorption line (BAL) quasar APM 08279+5255. These results are based on spectral fits to all the long exposure observations of APM 08279+5255 using a new quasar-outflow model. This model is based on cloudy simulations of a near-relativistic quasar outflow. The main conclusions from our multi-epoch spectral re-analysis of Chandra, XMM-Newton and Suzaku observations of APM 08279+5255 are: 1) In every observation we confirm the presence of two strong features, one at rest-frame energies between 1-4 keV, and the other between 7-18 keV. 2) We confirm that the low-energy absorption (1-4 keV rest-frame) arises from a low-ionization absorber with log N_H ~23 and the high-energy absorption (7-18 keV rest-frame) arises from highly ionized ($3 < \log \xi < 4$; where ξ is the ionization parameter) iron in a near-relativistic outflowing wind. Assuming this interpretation, we find that the velocities on the outflow could get up to $\sim$ 0.7c. 3) We confirm a correlation between the maximum outflow velocity and the photon index and find possible trends between the maximum outflow velocity and the X-ray luminosity, and between the total column density and the photon index. We performed calculations of the force multipliers of material illuminated by absorbed power laws and a Mathews-Ferland SED. We

found that variations of the X-ray and UV parts of the SEDs and the presence of a moderate absorbing shield will produce important changes in the strength of the radiative driving force. These results support the observed trend found between the outflow velocity and X-ray photon index in APM 08279+5255. If this result is confirmed it will imply that radiation pressure is an important mechanism in producing quasar outflows.

1.5 ***X-ray and UV Observations of Narrow Absorption Line Quasars with High Velocity Outflows***

George Chartas
College of Charleston

High velocity and massive outflowing winds may be present in most quasars but only detected in those cases where our line of sight intersects the outflowing absorbing stream. We present results from Chandra, Suzaku and XMM-Newton observations of a sample of Narrow Absorption Line (NAL) quasars with high velocity outflows. In contrast to what is found in Broad Absorption Line (BAL) quasars we do not detect any significant excess intrinsic absorption in NAL quasars and the maximum outflow velocities of the UV absorbers of NAL quasars do not appear to be correlated with their X-ray weakness. Our current analysis allows us to place tighter constraints on correlations between the amount of X-ray weakness and UV properties of the wind to better understand the geometry and acceleration mechanism of quasar winds.

1.6 ***1H 0419-577 and beyond: The Importance of the Hard X-ray Excess in AGN***

Malachi M. Tatum
University of Maryland, Baltimore County

A 2007 Suzaku observation of the type I AGN 1H 0419-577 revealed an unexpectedly high X-ray flux above 10 keV; this phenomenon was dubbed a hard excess, and is most naturally explained by the presence of a Compton-thick partial-covering absorber in the line-of-sight. A follow-up observation in 2010 confirmed the hard excess to be a persistent phenomenon in 1H0419-577. Given that, and the evidence for unexpectedly hard spectra in some other sources, we conducted an exploratory study of the importance of the hard excess phenomenon in the local population of type I AGN. We cross-correlated the list of type I AGN detected in the BAT 58-month survey with the holdings of the Suzaku public archive to construct an exploratory sample comprising 50 objects, totaling 64 observations. We have determined a hardness ratio, ie Flux(15-50 keV)/Flux(2-10 keV), of all such AGN. The distribution of hardness ratios shows the sample to be very hard compared to expectations from standard reflection models. We discuss the implications of the source ratio distribution, and in particular, the importance of and implications regarding Compton-thick absorbers in the line-of-sight in local type I AGN.

1.7 ***NGC 7314: X-ray Properties of a Candidate 'type II' NLSy1***

Mauro Dadina
INAF/IASF Bologna

We present preliminary results from the study of the type II Seyfert galaxy NGC 7314. Archival data by ASCA, BeppoSAX, Suzaku and XMM-Newton were used. We mainly focused on the long term properties of the high energy emission of the source and on its timing characteristics. Our results add further clues to the picture in which NGC 7314 is an absorbed counterpart of a NLSy1.

2.1 ***Constraining Variable High Velocity Winds from Broad Absorption Line Quasars with Multi-Epoch Spectroscopy***

Daryl Haggard
CIERA/Northwestern University

Broad Absorption Line (BAL) quasars probe the high velocity gas ejected by luminous accreting black holes. BAL variability timescales place constraints on the size, location, and dynamics of the emitting and absorbing gas near the supermassive black hole. We present multi-epoch spectroscopy of seventeen BAL QSOs from the Sloan Digital Survey (SDSS) using the Fred Whipple Observatory's 1.5 m telescope's FAST Spectrograph. These objects were identified as BAL QSOs in SDSS, observed with Chandra and then monitored with FAST at observed - frame cadences of 1, 3, 9, 27, and 81 days, as well as 1 and 2 years. We also monitor a set of non-BAL quasars with matched redshift and luminosity as controls. We identify significant variability in the BALs, particularly at the 1 and 2 year cadences, and use the magnitude and frequency of this variability to constrain the outflows impacting the broad absorption line region.

2.10 ***Cosmic Origins Spectrograph Observations of Intrinsic Absorption in Mrk 876***

Jennifer Scott
Towson University

We present new ultraviolet absorption data from the Cosmic Origins Spectrograph of intrinsic absorption in the Seyfert 1 galaxy Mrk 876 (z=0.129). This highly ionized outflow shows absorption in O VI and N V, with little or no C IV, at two velocities relative to the galaxy, ~3630 and ~3900 km/s. We will present measurements of the column density and covering fraction of the outflow components.

2.11 ***Absorption-Line Variability of Broad-Absorption Line Quasars***

Matthias Dietrich
The Ohio State University

About 20% of quasars show strong, broad, and blue-shifted absorption troughs

which are generally ascribed to absorption by fast outflowing material. While emission-line variability has been established as powerful tool to study properties of the broad-emission line region (BLR) in active galactic nuclei (AGN), e.g., the size of the BLR and the black hole mass, only in recent years for some BAL QSOs variations in strength and shape of the broad blue-shifted absorption features have been observed, and even changes of the location in velocity space. It is still open whether those changes happen gradually and on which timescales. In some cases rather dramatic changes are discovered, broad and deep absorption troughs basically vanished completely over a period of 1 to 9 years. We monitored a sample of nearly 25 BAL QSOs using the 2.4 m telescope at MDM Observatory and the 4 m telescope at KPNO, to study the properties of the broad absorption features on timescales of weeks to months. We will present first results on the timescales and amplitudes of the variations which we detected. We will discuss implications of the variability properties, e.g., for the location of the absorbing material, as well as for the stability of those outflows, in the context accretion disk models, assuming that a wind is launched from the disk and is causing these strong absorptions.

2.12 ***Broad Line Region Outflows and Virial Black Hole Mass Estimates***

Kelly Denney
Dark Cosmology Centre, Copenhagen

Recent velocity-resolved reverberation mapping results have shown indications of possible outflowing gas from the Hbeta emitting region of the broad line region around NGC 3227. I will present new velocity-delay maps based on this data and discuss the implications for reverberation black hole mass estimates. Additionally, I will discuss the reliability of CIV as a virial black hole mass estimator. The presence of self-absorption, blueshifts, and asymmetries observed in the CIV broad emission line has raised questions regarding the reliability of CIV as a mass indicator. I will present new results demonstrating that CIV-based masses are in agreement with those of Hbeta when data quality is made a priority and a color-term is applied to correct the masses.

2.13 ***Searching for Quasar Wind Signatures with UV through Mid-Infrared Spectral Energy Distributions***

Allison Hill
University of Western Ontario

We compile a sample of ~200 galaxies and quasars by cross-referencing the Data Release 7 Sloan Digital Sky Survey (SDSS) quasar catalogue with archival Spitzer infrared spectrograph (IRS) observations. For these objects, ranging in redshift from 0 to 2.5, we construct spectral energy distributions (SEDs) by adding photometry from SDSS, GALEX, 2MASS, and WISE to the SDSS and IRS spectra. Our ultimate goal in constructing this sample is to search for correlations between known UV wind signatures and features of the near-to-mid infrared SED.

2.14 ***Monitoring Quasar Colour Variability in Stripe 82***
Jesse Rogerson
York University

Broad Absorption Line (BAL) trough variability is predominantly due to cloud motion transverse to our line of sight. The rate at which the variability occurs indicates the velocity of the cloud, which can provide constraints on the cloud's distance from the central source. This requires detailed spectroscopy during a variability event. Such spectra have proven elusive, suggesting either the timescale of variability is too short to be caught, or too long to notice until a sufficient amount of time has passed. Photometric monitoring of BAL quasar colours may potentially be used as an early warning system to trigger time resolved spectroscopic monitoring of BAL variability. Towards this end, we present an analysis of both BAL and non BAL colour variability using time series photometry from Stripe 82 in the Sloan Digital Sky Survey.

2.15 ***Broad Absorption Line Variability in Radio-Loud Quasars***
Brendan Miller
University of Michigan

We investigate broad absorption line (BAL) variability within a sample of 35 radio-loud quasars (RLQs) using Sloan Digital Sky Survey (SDSS) spectra along with new Hobby-Eberly Telescope (HET) observations (20 objects) or two-epoch SDSS coverage (15 objects). By comparison to BAL variability in radio-quiet quasars (RQQs), we aim to assess whether BAL outflows in RLQs have a similar physical origin to those in RQQs. The BAL RLQs were selected from SDSS/FIRST data and include both core-dominated (32) and lobe-dominated (3) objects; their radio luminosities and radio-loudness values span 2.5 orders of magnitude, and a substantial fraction have large BAL velocities (16/35 exceed 10000 km/s) and equivalent widths (13/35 exceed rest-frame 15 Angstroms). Only modest BAL variability is detected on rest-frame timescales of 20-1000 days: the mean absolute fractional change in equivalent width is 0.08, exceeds 0.15 for only 6/35 objects, and in no cases is greater than 0.30. We do not find any correlation between the absolute fractional change in equivalent width and radio luminosity or radio-loudness. There is a possible tendency for lobe-dominated objects to display greater variability, but a larger sample is required for confirmation. Comparison to variability in BAL RQQs does not reveal significant differences in the distribution of fractional change in equivalent width. This suggests that the mechanism of BAL production within this sample of RLQs may be similar to that of the comparison BAL RQQs.

2.16 ***Constraining AGN Outflow Kinetic Luminosity with C III* Absorption***
David Austerberry
Creighton University

It has been postulated that galaxy formation can be significantly affected by gas

outflows from the AGN of a nascent galaxy. Hence, a lower limit on the ratio of an outflow,s kinetic luminosity to the bolometric luminosity of its quasar is of interest if it is above a level critical to galaxy growth and evolution. Kinetic luminosities of several AGN outflows were obtained through analysis of Sloan Digital Sky Survey spectra in conjunction with photoionization models run using CLOUDY. The strength of absorption by C III* (1175 Å) is indicative of the density outflow gas density since the abundance of this ion relative to other carbon ions is highly sensitive to gas density in moderate to high ionization environments. Thus, limits on C III* column density (NCIII*) and other ionic column densities measured in spectra were compared to column density predictions in a grid of models with varying ionization parameter, hydrogen density, and hydrogen column density. The low resolution and SNR of SDSS spectra lead to an exaggerated upper limit on NCIII* and correspondingly conservative lower limit on outflow kinetic luminosity. Because these limits on kinetic luminosity from SDSS spectra were too small to be relevant to questions about AGN feedback, a proposal for ground-based, high resolution observations will be submitted to the National Optical Astronomy Observatory. The resolution and SNR requirements for these observations are driven by C III* detection against Lyman-α; lines and the calculation of NCIII*. In the event that the component lines of the C III* multiplet are resolved, the resulting precise calculation of outflow density will produce a tightly constrained kinetic luminosity.

2.17 ***The Location of Reddening Sources in FeLoBAL Quasars***

Jay Dunn
Georgia Perimeter College/The Catholic University of America

We present the results of a search for objects that exhibit both strong narrow line emission for Balmer H(beta) lambda4361 Ang, H(gamma) lambda4340 Ang, as well as broad absorption lines (BALs) due to MgII lambda2800 Ang and FeII lambda2600 Ang. associated with outflows (FeLoBALs). We found 2 objects in a search of all spectra taken by the SDSS through Data Release 7. Furthermore, we also include one object that was known prior to our investigation that does not show the FeII absorption in the SDSS spectrum. The strong Balmer lines associated with the narrow line region (NLR), allow us to determine if the source of reddening seen in these objects, common in FeLoBALs, lies interior to the NLR for these three objects, which has implications on the estimations of energetics for the outflows in general.

2.2 ***Multi-epoch Observation of CIV Absorption Variability in APM08279+5255***

Dario TREVESE
Universita' di Roma 'La Sapienza'

Variability of Broad Absorption Lines (BALs) potentially represents a powerful tool to investigate the physical nature and the structure of gas outflows. Most existing BAL variability studies rely on observations taken at two, or in some cases at a few, epochs and ensemble properties have been derived for two samples of

about 30 BAL QSOs each. In the present contribution we present the first 'monitoring' of a single object, APM08279+5255, which has been observed with the 1.8 m telescope in Asiago (Italy) more than 20 times since 2003. Two high-resolution spectra, from Keck and HST respectively, have also been included in the analysis extending the time interval from 1998 to 2011. A decreasing trend of the equivalent width W of the CIV absorption is found on a typical rest-frame time scale of about 5 years. A structure function analysis of W variations is presented and compared with the ensemble BAL properties described in the literature. Multi-epoch observation of CIV absorption variability in APM08279+5255

2.3 ***Large BALQSO Fractions Inferred from NIR and Radio Surveys: Implication to AGN and Feedback Models***

Xinyu Dai
University of Oklahoma

Combining the SDSS, 2MASS, and FIRST surveys, we find large BALQSO fractions in the NIR and radio detected samples, 20-40% for Hi-BALQSOs, 3-7% for Lo-BALQSOs, and 1.5-2% for FeLoBALs. These fractions are two, 3-5, and 10 times higher than the corresponding fractions observed in the optical bands. Considering the intrinsic obscuration for BALQSOs, we can successfully explain the high BALQSO fractions measured in the NIR and radio detected sample. We also argue that these fractions are closer to the intrinsic fractions for BALQSOs of different species. We find the fractions of BALQSOs drop with increasing radio luminosity, which can be easily explained using a geometric model. For LoBALs, we find a luminosity dependent component that can possibly interpreted as quasars in early evolutionary stages. The larger LoBAL/FeLoBAL fractions inferred from our studies suggest that LoBALs/FeLoBALs can provide similar feedback energy as the more populated HiBALs.

2.4 ***Constraining Accretion Disk Wind Theory with Intrinsic Narrow Absorption Lines***

Drew Clausen
The Pennsylvania State University

The spectra of half of all quasars exhibit intrinsic narrow absorption lines (NALs). NALs are useful for constraining the physical conditions in the outflowing gas because they are common and the UV doublets (e.g., C IV, Si IV, and N V) are unsaturated and narrow enough to be resolved. In recent years models of accretion-disk winds have reached a level of sophistication that allows them to be tested against the physical conditions derived from high spectral resolution observations of NALs. To facilitate the comparison between theory and observation, we have developed software to compute the absorption-line profiles using prescriptions for the velocity and density fields predicted by such models. The code divides the outflow into several slabs, each with a velocity and density determined by a user supplied function or interpolation table. The width of each slab is adjusted such that the velocity dispersion across the slab due to the bulk

flow is of the order of the local sound speed. Next, the program runs a Cloudy photoionization calculation to determine the ionic column densities through each slab. The transmitted continuum from each slab is used as the input continuum for the neighboring slab, which accounts for changes in the shape and intensity of the ionizing radiation's spectral energy distribution as it propagates through the outflow. Finally, the line profiles are synthesized using the column densities, velocities, and temperatures though a series of slabs along a line of sight through the outflow. Our code also explores the effects of continuum filtering, where by the continuum source passes through an absorbing medium before reaching the filaments that produce the observed UV absorption lines. Used along side observations of NALs, our synthesized absorption-line profiles can be used to constrain the composition, density, length scales, and acceleration mechanism of quasar accretion disk winds. This work was supported by NSF grant AST-0807993

2.5 ***Probing Quasar Winds Using Intrinsic Absorption Lines***

Christopher Culliton
Penn State University

We use the spectra of 73 quasars from the VLT UVES archive at z = 1.5 - 5 to expand the sample of Misawa et al. (2007) in order to study the narrow absorption lines (NALs) that are intrinsic to (physically associated with) the quasars. We calculate the coverage fraction of the background source(s) by absorbing gas through multiple methods in order to determine which NALs are intrinsic to the quasar itself, as opposed to a cosmological absorber along the line of sight. Of the 414 systems identified, 377 are detected in C IV, 24 in N V, and 56 in Si IV systems. We find 89 systems to be associated systems (within 5000 km/s of the emission redshift of the quasar). A minimum of 24% of the associated systems are reliably intrinsic, with an additional 10% being possibly intrinsic, and even more intrinsic systems with unity coverage fractions are possible. The minimum percentage of quasars with at least one C IV intrinsic NAL is estimated to be 33%, whereas that of quasars with at least one intrinsic NAL, regardless of transition, is 41%. This result neccessitates that models of NAL origins be able to explain such large sky coverage. Within our sample, 8%-19% of all C IV NALs (associated or not) were reliably to potentially intrinsic, while 9% - 22% of all NALs, regardless of which type of transition, were reliably to potentially intrinsic. Two different families of intrinsic NALs were identified in Misawa et al. (2007), those with strong N V absorption, and those with relatively weak N V absorption, but with a C IV doublet displaying a coverage fraction less than unity. These familes are observed in our larger sample, as well. We discuss the idea that the diversity of ionization parameters creating the various ion families could be due to a wide range of distances from the continuum source. We also compare the data to two models for the origin of the absorbing gas: (A) dense filaments embedded in an accretion disk wind, (B) gas from the host galaxy that is swept up as the wind propagates away from the central engine. This work was supported by NSF grant AST-0807993.

2.7 ***Constraints on the Absorber in Markarian 509 from Time Variablility***
Doug Edmonds
Virginia Tech

UV spectra of Mrk 509 from COS and STIS separated by 8 years reveal small changes in absorption troughs of C IV and N V despite the ~80% increase in flux. Using time-dependent photoionization simulations, we establish the conditions that result in the observed changes.

2.8 ***Tomography of the UV Outflow in IRAS F22456-5125 Using High S/N HST COS Observation***
Benoit C.J. Borguet
Virginia Tech

In recent years AGN outflows have gained strong interest as a main agent in AGN feedback scenarios. Determining the mass flux and kinetic luminosity from these outflows requires an accurate determination of the column densities as well as a distance estimate to the outflow. Using the brand new UV COS spectrograph on board of the HST, we obtained high S/N spectrum of IRAS F22456-5125 allowing us to derive the physical conditions as well as accurate distance determination for several components of the UV outflow.

2.9 ***Multi-Sightline Spectroscopy of Outflowing Winds in Quasar SDSS J1029+2623***
Toru Misawa
Shinshu University

The disk outflow, powered by various mechanisms, is the most important key ingredient for the evolution of quasars as well as for the galaxy formation/evolution. Such outflowing matter is likely to be responsible for broad absorption lines (BALs) observed in the spectra of a fraction of quasars. However, the weakness of studies of BALs is that we can trace them through only single sight-lines toward the nucleus for each quasar, although absorber's physical condition would depend on polar angles. The current largest separation lensed quasar, SDSS J1029+2623, with separation angle of 22'.5, is lensed by a massive 'cluster of galaxies'. If there exist absorbers at a distance of 1 kpc from the continuum source, the separation would be > 0.1 pc, with which we may trace outflowing winds with different physical properties unless their transverse sizes are much larger than the sub-parsec scale. Interestingly, we see a clear difference in CIV BAL-like features between images. Here, simple implications can be proposed: (i) this is due to the time variability of a large-scale (> 0.1 pc) single absorber because the time-delay between images is ~1860 days, and (ii) we see different regions of the outflowing wind to multiple sight-lines as previously proposed by Green (2006). We performed additional spectroscopic observations of the quasar in low-resolution (to distinguish the scenarios above)

and in high-resolution (to evaluate physical parameters of the outflow gas) with the Subaru telescope. Our results support the latter scenario.

4.1 ***Integral Field Spectroscopic Mapping of Nuclear Outflows in NGC2110***
Allan Schnorr Müller
Universidade Federal do Rio Grande do Sul

We present two-dimensional gaseous kinematics of the inner 1.02 x 1.45 kpc^2 of the Seyfert 2 galaxy NGC 2110 from optical data obtained with the GMOS integral field spectrograph on the Gemini South telescope at a spatial resolution of ~90pc. The Hα+[N\,II] emitting gas shows a kinematics dominated by rotation, but subtraction of a circular rotation field reveals outflows cospatial with the bi-polar radio jet, oriented along the major axis (north-south), and extending to a distance of ~360 pc from the nucleus. Although apparently oriented close to the plane of the sky, the observed (projected) velocities of the outflow reach up to 100 km s^{-1}, meaning that the actual outflow velocities may be a few times larger. We also find what seems to be a second outflow almost perpendicular to radio jet with similar velocity to the first one, but with a higher velocity dispersion -- of up to 200 km/s when compared to ~100 km/s of the north-south outflow.

4.2 ***Kinematics and Excitation of a Nuclear Spiral in the Active Galaxy Arp 102B and Its Relation with Outflow***
Guilherme S. Couto
IF-UFRGS (Brazil)

We present gas kinematics and excitation within the inner kiloparsec of the radio galaxy Arp 102B, using integral field spectroscopy obtained with the Gemini North Multi-Object Spectrograph Integral Field Unit (GMOS IFU) with a spectral coverage from 4400 to 7300A. Despite being classified as a elliptical, ACS HST images have revealed two nuclear spiral arms, towards the east an west in the H alpha emission line whose nature is unclear, since the eastern arm seems to be associated with a radio structure observed in a 8.4 GHz VLA image. In order to investigate the origin of the spiral arms, we have obtained flux and line ratio maps, as well as centroid velocity and velocity dispersion maps in several emission lines. The east arm and a suggestion of the west arm is seen in all flux maps. Channel maps show that the eastern arm -- which is correlated with the radio emission -- presents mostly blueshifts, and centroid velocity maps suggest an outflow plus rotation scenario. PCA analysis suggest the presence of two structures in the emitting gas, which can be interpreted as an outflow along the arms and a compact rotating disk closer to the nucleus and perpendicular to the arms.

4.3 ***Gas Kinematics and Excitation in the Inner Few Hundred pcs of NGC 1068 from Gemini NIFS Observations***
Tibério Borges Vale
UFRGS/Brazil

We present results from near-IR integral field spectroscopy in the J, H and K bands of the inner 350 × 350 pc^2 of NGC 1068 at a spatial resolution of 8 pc. We present emission-line intensity maps of [PII], [SIX], [FeII]$(1.257\mu m)$, Pa β, FeII $(1.644\mu m)$, H_2, Br γ and [CaVIII], as well as line-ratio maps. The $[FeII]\,1.644\mu m$ emitting gas shows a bi-polar hourglass shaped morphology oriented along NE--SW, which shows outflows approximately co-spatial with the one previously observed in the optical [OIII] 5007 A, emission line. The Pa β and Br γ emitting gas are also elongated in the same orientation, while the coronal gas emission is more compact but still resolved, consistent with an origin in the inner narrow-line region. The flux distribution of the molecular H_2 gas is completely distinct from that of the ionized gas emission, being concentrated in a circumnuclear ring with a diameter of 220 pc and with a kinematics suggesting inflow of gas towards the nucleus. We also present the results of a code (developed in Python) to create movies from sequences of channel maps extracted from the datacube along the emission-line profiles in velocity space. These movies enable us to quickly inspect the kinematics of the emitting gas.

5.1 ***Model of Electron-positron Wind Near the Black Hole***

Monika Moscibrodzka
UIUC/UNLV

Electron-positron pairs may be produced near accreting black holes by a variety of physical processes, and the resulting pair plasma may be accelerated and collimated into a relativistic jet. We use a fully self-consistent, dynamical and radiative model to investigate pair production by \gamma\gamma collisions in weakly radiative accretion flows around a rotating black hole. The pair production rates are calculated from first-principles using Monte Carlo methods. Based on this results, we build an analytical and a numerical models of the electron-positron wind near the spinning black hole. We calculate the wind dynamics self-consistently using a GRMHD code with source terms accounting for mass, momentum and energy transfer associated with new particles injection. The wind structure is determined within a few gravitational radii. The corresponding Lorentz factor at large radii (10^4 Rg) may reach up to 200. We finish with a discussion of the model in context of jets and winds from Low Luminosity Active Galactic Nuclei.

5.2 ***Modeling Line-driven Disk Wind for Broad Absorption Lines of Quasars***

Mariko Nomura
Ochanomizu University

The disk wind, which is powered by the radiation force due to spectral lines (line force), is studied as a plausible model for broad absorption line (BAL) quasars (Proga et al. 2000, Risaliti & Elvis 2010). We investigate the structure of the outflow from the disk and compare with X-ray observations of BAL quasars. We

found that the funnel-shaped disk winds are ejected and the absorption features are detected for an observer with larger viewing angle. We also found that BALs appear for massive black hole and larger Eddington ratio. This result proposes a new picture whereby the BAL and non-BAL quasars are divided by the combination between the black hole mass and the Eddington ratio in cooperation with the observer's viewing angle. Additionally, our model supports the hypothesis that the wind-base (disk surface) emits the broad emission lines (Ganguly et al. 2003).

5.3 ***Quasar Narrow Absorption Lines - A connection with Disk Winds?***

Marianne Vestergaard
Dark Cosmology Centre, Copenhagen

Quasar broad absorption lines most likely take their origin in dense gas outflowing from the nucleus in a direction close to our line of sight. It has been suggested that narrow absorption lines take their origin in outflowing gas moving more transverse to our line of sight. I will present work that investigates the latter issue. Using estimates of the black hole mass and predictions from accretion disk theory and disk wind models I test how well observations match expectations at the present time. In particular I test if the observed properties of quasar narrow absorption lines are generally consistent with the absorbing gas being launched from the accretion disk.

5.4 ***Parker Winds Extended to the Disk Regime***

Timothy R. Waters
University of Nevada, Las Vegas

Parker winds have commonly been invoked as a mechanism to explain or predict outflows from astrophysical systems thought to be hot enough to exhibit a non-explosive thermal expansion of gas. To complement the detailed analytical solutions that exist for spherical systems, which can be applied to stars and planets, we present solutions for a biconical flow geometry that can be applied to systems hosting accretion disks. We calculated synthetic line profiles assuming various launching angles and differing degrees of streamline divergence, revealing the effects that geometry alone can have on the observations of disk winds.

5.5 ***MHD Disk Winds and Line Width Distributions***

Laura Chajet
York University (Toronto, Canada)

We study AGN emission line profiles combining an improved version of the accretion disk wind model of Murray & Chiang (1997) with the magnetohydrodynamic model of Emmering et al. (1992). We show how the shape, broadening and shift of the C IV line depend not only on the viewing angle to the object but also on the wind launching angle. The dependence is more

noticeable for small launching angles above the disk. We have compared the dispersions in our model C IV linewidth distributions to the observed upper limit on that dispersion found by Fine et al. (2008, 2010). We have considered both an opaque torus of fixed half-opening angle and the physically motivated obscuration model of Mor et al. (2009). As the torus half-opening angle (measured from the polar axis) increases above about 18 degrees, increasingly larger wind launching angles are required to match the Fine et al. constraints. Above a half-opening angle of about 47 degrees, no wind launch angle (within the maximum allowed by the MHD solutions) can match the observations.

5.6 ***Modeling Line-driven Disk Wind for Broad Absorption Lines of Quasars***

Mariko Nomura
Ochanomizu University

The disk wind, which is powered by the radiation force due to spectral lines (line force), is studied as a plausible model for broad absorption line (BAL) quasars (Proga et al. 2000, Risaliti & Elvis 2010). We investigate the structure of the outflow from the disk and compare with X-ray observations of BAL quasars. We found that the funnel-shaped disk winds are ejected and the absorption features are detected for an observer with larger viewing angle. We also found that BALs appear for massive black hole and larger Eddington ratio. This result proposes a new picture whereby the BAL and non-BAL quasars are divided by the combination between the black hole mass and the Eddington ratio in cooperation with the observer's viewing angle. Additionally, our model supports the hypothesis that the wind-base (disk surface) emits the broad emission lines (Ganguly et al. 2003).

5.7 ***Photoionization Modeling with TITAN Code Distance to the Warm Absorber***

Agata Rozanska
N. Copernicus Astronomical Centre Polish Academy of Science

We present the method that allows us to estimate a distance from the source of continuum radiation located in the center of AGN to the highly ionized gas - warm absorber (WA).

5.8 ***How to Hide a Supermassive Black Hole***

Name: Anton Dorodnitsyn
Affiliation:

A fundamental assumption of the active galactic nuclei (AGN) unification scheme(s) is that type 1 and type 2 AGNs have similar intrinsic properties. The basic premise of this approach is that an obscuration via dusty torus is responsible for the observational dichotomy of AGNs. For the first time we suggest a model and employ 2.5D full time-dependent radiation hydrodynamics simulations demonstrating that an obscuration at parsec scale can be produced

by the dense, dusty wind which is supported by infrared radiation pressure on dust grains. The results demonstrate that obscuration via infrared-driven winds is a viable option for the AGN torus problem and AGN unification models.

5.9 ***On-line Java Tools for Analyzing AGN Outflows***
Carter Chamberlain
Virginia Tech

We present six interactive programs created to aid in the analysis of outflows from AGN, including three photoionization tools, a spectral identification tool, and two calculators. 1. An interactive plot showing the ionic fraction versus the ionization parameter, for each ion of several elements and for different SEDs. 2. An interactive plot showing the ratio between the excited level column density and the resonance level column density versus electron number density for several elements. Determining the electron number density in this way is the first step to measure the distance of the outflow from the central source. 3. A tool for finding the ionization parameter solution from the measured column densities. The user provides the measured ionic column densities and chooses an SED. Then the program displays the locus of possible models in a plot of Hydrogen column density versus ionization parameter. The program also calculates and overlays a chi-squared map for one- or two-ionization parameter solutions. 4. A spectral identification tool displays a spectrum, and allows the user to interactively identify the absorption features. This will give the redshift of each outflow and intervening system along the line of sight to the quasar. 5. Two calculators a) Calculate the velocity of an outflow given the systemic redshift and the absorber redshift. b) Convert GALEX flux to units of ergs/s/cm2/angstrom.

6.1 ***A CHandra Survey of Extended Emission-line Regions in Nearby Seyfert Galaxies (CHEERS): Revealing the Impact of AGN Winds***
Junfeng Wang
Harvard-Smithsonian CfA

To improve our understanding of AGN feedback, it is crucial to evaluate the true role of AGN outflows on galaxy evolution observationally. I will present new results from Chandra high-resolution survey of extended emission-line regions in nearby Seyfert galaxies, which offers a unique opportunity to examine feedback in action in much greater detail than at high redshift. In particular, findings on the morphologies, energetics, and interactions with host galaxies will be discussed in detail. Exploiting Chandra's highest possible resolution, we find evidence for X-ray emission from interaction between outflow and the optical narrow-line region clouds, in addition to the emission from the photoionized bi-conical outflow.

6.2 ***Fermi Bubbles of the Milky Way: Echoes of the Last Quasar Outburst?***
Kastytis Zubovas
University of Leicester

The recently discovered Fermi Bubbles are two large, teardrop shaped structures situated on either side of the Galaxy symmetrically around its plane. Morphologically, they seem to have a point of origin at the Galactic centre. We propose that they are the result of a short burst of Eddington-limited AGN activity of Sgr A*, the SMBH at the centre of our Galaxy. The outburst drives a wind into the surrounding gas, which produces an outflow. This outflow is collimated by the uneven density distribution in the Galaxy, most crucially the presence of a cold molecular gas ring known as the Central Molecular zone. We present both analytical estimates and results of numerical simulations of the process. We find that this simple model can explain both the morphology and the energy content of the Fermi bubbles.

6.3 ***What Determines the Velocity of Quasar Outflows?***

Rajib Ganguly
University of Michigan - Flint

Models have shown that quasars are a crucial ingredient in the evolution of massive galaxies. Outflows play a key role in the story of quasars and their host galaxies, helping regulate the accretion process, and the star-formation rate and mass of the host galaxy (i.e., feedback). The prescription for modeling outflows as a contributor to feedback requires knowledge of the outflow velocity, geometry, and column density. In particular, it is paramount to understand how these depend on physical parameters, and how much is determined stochastically (and with what distribution). With the goal of establishing a more complete description of these three properties, we are examining a sample of 11000 z=1.7-2.0 quasars from the Sloan Digital Sky Survey (SDSS). The redshift range permits us to use the SDSS spectra to: (1) separate objects that do and do not exhibit outflows; (2) classify/measure outflow properties (ionization, velocity, velocity width); and (3) estimate the quasar black hole masses. To this, we are adding photometry from GALEX, 2MASS, and ROSAT to more fully characterize the quasar SEDs and the bolometric luminosities. In this poster, we will present an exploration of what parameters play a role in determining the velocity, and observed velocity width. In addition, we conduct an experiment using a carefully-selected broad absorption-line (BAL) quasars from this sample. These BAL quasars are chosen to have very narrow ranges in (1) UV luminosity, (2) UV spectral shape, and (3) absorption velocity width. Within this otherwise uniform sample, the outflow velocities range over a factor of four from 4500km/s to 18000km/s. Twelve of these objects were targeted for exploratory observations with Chandra-ACIS. We discuss the results of these observations and compare the X-ray brightnesses and spectral shapes of our sample with those of more diverse samples of BAL quasars. This material is based upon work supported by the National Aeronautics and Space Administration under Grant No. 09-ADP09-0016 issued through the Astrophysics Data Analysis Program and through Chandra grant GO9-0120X.

6.4 ***The Bardeen-Petterson Effect as the Precession Mechanism for the Radio Galaxy NGC1275 (3C84)***

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NGC 1275 is a giant elliptical galaxy at the center of the Perseus cluster of galaxies. It is associated to a strong radio source (3C84) and presents X-ray emission that extends well into the intergalactic medium. The X-ray maps present multiple misaligned pairs of cavities, some of them coincident with maxima in the radio emission, which had been interpreted as bubbles inflated by a precessing radio jet. Through 3D hydrodynamical simulations we have found that bubbles can be formed only under some restricted precession conditions, and that the Bardeen-Peterson effect could be responsible for the torques driving this precession. Using the results obtained in the numerical simulation we have been able to derive the radio structure expected from a jet precessing according to this process, using parsec scale radio observations as constrains, and obtain the precession parameters that are compatible with both the radio image and the inflation of the X-ray bubbles. Using other properties of the radio galaxy, like bolometric luminosity, mass of the central black hole, and absorption of the radio counterjet by the accretion disk, we were able to put limits on the accretion disk parameters and on the rotation rate of the black hole.