# The Restless Nature of AGNs: variability as a probe of the central source

Naples, May 20-23, 2013

Book of Abstracts

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*Monday 20-5*
*Session: X-ray flux and spectral variability I*

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**Review: M. Cappi (INAF/IASF-Bo)**
**X-ray reverberation studies in AGN: an overview**
X-ray positive and negative time-lags (also called time-delays or reverberation lags) have been found to be common, and maybe ubiquitous, in active galactic nuclei (AGN). They clearly provide a new tool to probe the physics and geometry of the accretion regions very close to the supermassive black hole, but how close to it is still a matter of debate. In this talk, I will present an overview of the recent, admittedly impressive, advances in this field.

**Dimitrios Emmanoulopoulos (University of Southampton)**
**General relativistic modelling of the negative X-ray reverberation time delays observed in AGN.**
Detection of negative X-ray reverberation time delays (i.e. soft band X-ray variations lagging behind the corresponding hard band X-ray variations) in Seyfert galaxies, can yield significant information about the physical properties around the very near black hole (BH) environment. The physical origin of these delays is greatly debated, as is the question of their ubiquity in accretion systems. In the frame-work of the lamp-post geometry, I will be presenting X-ray time-lag modelling results using general relativistic (GR) transfer functions, yielding heights, viewing angle s and BH spin parameters. All the relativistic effects on both the photon energies and trajectories e.g. aberration and light bending, are incorporated during the modelling improving significantly on the currently used parametrisation models of simple top-hat transfer functions.

**Rozenn Boissay (Geneva Observatory – ISDC)**
**Testing ionized-blurred reflection models using the Mrk 509 XMM-Newton and INTEGRAL campaign**
An excess of X-ray emission below 1 keV, called soft-excess, is present in the spectra of about 50% of the Seyfert 1s. The origin of this feature remains debated. This soft excess could be due to ionized reflection from the disk, blurred by the strong gravity of the black hole. In order to test this ionized reflection model, we used XMM-Newton and INTEGRAL data from the bright Seyfert 1 galaxy Mrk 509, for which we obtained ten long simultaneous observations every four days. We study the variation of the different parameters driving blurred reflection. From the evolution of these parameters and by studying variability, we assess the relevancy of blurred reflection models to explain the soft-excess in this object.

**Alessandra De Rosa (IAPS/INAF)**
**Variability as a probe of the central engine: the LOFT perspectives**
The variability of Seyfert galaxies in the X-ray energy domain represents a powerful tool to probe the regions around the supermassive black hole on all scales. In particular, using tomography and reverberation of the Fe line, the accretion flow around the SMBH can be mapped in a number of ways, providing direct checks on the geometry of the innermost emitting and reprocessing regions. LOFT, with its extremely high throughput and CCD-class spectral resolution, will open a whole new domain of X-ray spectral-timing analysis. Thanks to its sensitivity and broad energy range (2-50 keV), LOFT will be able to determine with very high signal to noise and accurate continuum subtraction the profile the Fe K-lines in AGN and its variability in response to flares, revealing the orbital motion of individual blobs and finally providing BH mass and spin. In addition, the wide energy band and the large effective area above 10 keV, will allow the study of the circumnuclear emitting/absorbing regions nearby the central BH in the case of bright AGNs.

**Review: Ian Mc Hardy (University of Southampton)**
**AGN X-ray variability, scaling relationships and relationship to binary variability**
I will review the observations of AGN X-ray temporal variability, including scaling relationships for characteristic timescales based on both the high frequency part of the PSD and the bend timescale and relationship to binary systems. I will investigate whether similar scaling relationships apply to variability in the other wavebands. I will also briefly touch on what simple continuum spectral variability on timescales scaled between AGN and binaries tells us about the X-ray emission process in accreting black holes as a function of accretion rate.

**Phil Uttley (University of Amsterdam)**
**Decoding AGN variability: the view from the bottom of the mass scale**
The last few years have seen a mini-revolution in our understanding of variability from accreting supermassive and stellar mass black holes, partly driven by a combination of spectral and timing data, in particular the measurement of time lags between the different spectral components such as the disc and power-law emission. I will show how the excellent spectral-timing data from black hole X-ray binaries can be used to inform our understanding of AGN variability, through direct measurement of accretion-flow variability on characteristic (i.e. mass-scaled) time-scales which are too slow to sample effectively in the supermassive sources.

**Simone Giacché (Max Planck Institute for Nuclear Physics-MPIK)**
**Analysis of X-ray spectral variability and black hole mass determination of Mrk 766**
We present an XMM-Newton time resolved spectral analysis of the Narrow Line Seyfert 1 galaxy Mrk 766. We analyse eight observations of the EPIC-pn camera taken between May 2000 and June 2005 in order to relate spectral variations with the mass accretion rate properties of the AGN. The 0.2-10 keV spectra are extracted in time bins longer than 3 ks in order to have at least 3x10^4 net counts in each bin and then accurately trace the variations of the best fit parameters of our adopted reference model. The scenario we are testing is in general applicable to any physical system powered by the accretion mechanism, where the seed soft photons are efficiently up-scattered via inverse Compton scattering in a hot and dense electron corona surrounding the central compact object. The resulting spectrum has a characteristic power-law shape, whose slope increases for large values of the normalisation of the seed component, that is proportional to the mass accretion rate dot{m} (in Eddington units). Our study reveals that the correlation, observed in Galactic Black Hole sources (GBHs), may also holds for extragalactic black hole sources and we argue that the spectral changes detected in Mrk 766 are related to the variations of dot{m}, like those observed in x-ray binary systems. We finally applied a scaling technique based on the slope of the observed correlation and average model normalisation to estimate the BH mass in Mrk 766. This technique is commonly and successfully applied to measure the masses of GBHs, and this is the first time it is

systematically applied to estimate the black hole mass in an AGN. We obtain a value of $M_{BH}=9.46^{+9.60}_{-7.74}x10^{5}M_{solar}$ that is in very good agreement with the evaluation performed with the reverberation mapping method.

**Hirofumi Noda (University of Tokyo)**
**Soft and Hard X-ray Excess Variability in Type I AGNs**
X-ray spectra of type I Active Galactic Nuclei (AGNs) generally show an excess structure in the soft band, above a continuum which is usually approximated by a single power law (PL). Although this soft-excess phenomenon has been explained in various ways, its origin remains ambiguous, because these interpretations often degenerate in spectral analyses. To overcome the spectral ambiguity, we developed a simple but powerful method of intensity-correlated spectral analysis, with which multiple components with independent variability can be decomposed. Applying it to the soft X-ray bands of several type I AGNs, we ubiquitously detected a soft component varying more slowly than the dominant PL, and identified it with the long known spectral soft excess. Furthermore, this soft component was successfully reproduced with a Comptonization model with a relatively low electron temperature and a large optical depth, presumably representing a different coronal region from that which produces the PL (Noda et al. 2011b, 2013). This means that the central engines of these AGNs are in a condition of multi-zone Comptonization (MZC). Applying the same analysis to a broad harder band above 1 keV of several AGNs, we successfully extracted a hard continuum and prominent Fe-K lines as slowly variable signals. Although these signals are partially accounted for by reflection from cold and distant materials, the rest can be explained by neither a partially-absorbed primary component, nor reflection from ionized materials with relativistic effects. Therefore, an additional continuum, unidentified so far, is suggested to lurk in the broad-band emission of many disk-dominated AGNs. This new hard component may also be emitted by the MZC corona.

**Andrew Lobban (University of Leicester)**
**The Strong X-Ray Variability of NGC 4051: Evidence for a Clumpy Compton-Thick Disc Wind?**
NGC 4051 is one of the most variable narrow-line type-1 Seyfert galaxies known with an observed X-ray spectrum that can vary in flux by a factor of more than 2 on kilosecond timescales. Furthermore the source is also known to occasionally fall into extended periods of very low flux. Such variability is often accounted for with reflection- or absorption-dominated models. In the case of NGC 4051, I will show that the lack of a strong iron line makes the broad-band spectrum challenging to model with reflection alone. Instead, through studies with Suzaku, Chandra and XMM-Newton, the strong evidence for significant columns of outflowing absorbing gas along our sightline and the relative constancy in flux of the weak iron line (over timescales of many years) may suggest that the observed variability could instead be explained by a Compton-thick, high-velocity clumpy accretion-disc wind. Such a wind may then be energetically important in terms of feedback with the host galaxy.

**Ken Ebisawa (JAXA/ISAS)**
**Origin of X-ray Spectral Variation and the Seemingly Broad Iron-Line Spectral Feature in Seyfert Galaxies**
We present systematic X-ray data analysis of the Seyfert galaxies observed by Suzaku to studyorigin of their hard X-ray (2 - 40 keV) variations. In particular, we examine if the ``Variable Partial Covering (VPC) model" proposed by Miyakawa, Ebisawa and Inoue (2012), which was

successful to explain spectral variations of MCG-6-30-15, is also valid for other Seyfert galaxies. In this model, intrinsic X-ray luminosity of the AGN is not significantly variable, and most observed flux and spectral variations are caused by change of the geometrical covering fraction of the extended X-ray source by ionized absorbing clouds in theline of sight. We found that the observed flux and spectral variations of 20 targets in addition to MCG-6-30-15 are successfully explained by the VPC model. The transmitted spectral component through the absorbing clouds has a characteristics spectral feature of the ionized iron K-edge, which is considered to be theorigin of the seemingly broad iron-line feature commonly observed in Seyfert galaxies. Variation of the partial covering fraction of the constant X-ray luminosity source causes such an anti-correlation between the direct (non-obscured) component and the transmitted (obscured) component, that cancels their variations each other. The cancellation works most effectively at the energy band where intensities of the two components are the closest to each other, namely, just below the iron K-edge. This explains the significantly small fractional variations in the iron K-energy band, another well-known observational characteristic of Seyfert galaxies.

**Jiri Svoboda (European Space Astronomy Centre of ESA)**

**Evidence of partially-covering absorber and transient relativistic iron line in Seyfert galaxy 4U 1344-60**

X-ray bright active galactic nuclei represent a unique astrophysical laboratory for studying accretion physics around super-massive black holes. 4U 1344-60 is a bright Seyfert galaxy that revealed relativistic reflection features in the archival XMM-Newton observation. I will present the spectroscopic results of new data obtained with the Suzaku satellite and compare them with the previous observation. The X-ray continuum of 4U 1344-60 can be well described by a power-law component with the photon index 1.7 modified by a fully and a partially covering local absorbers. We me asured a substantial decrease of the fraction of the partially absorbed radiation from around 45% to less than 10% while the power-law slope remains constant within uncertainties. The iron line in the Suzaku spectrum is relatively narrow, without any suggestion for relativistic broadening. Regarding this we interpret the iron line complex in the archival XMM-Newton spectrum as a narrow line plus an enhanced emission from the innermost accretion flow. The detected red-shifted iron line emission is probably a temporarily enhanced emission from the innermost accretion flow during the XMM-Newton observation.

**G. Ponti (MPE Garching)**

**The past X-ray history of the galactic center**

The Milky Way centre hosts a supermassive Black Hole (BH) with a mass of $4x10^6$ $M_{sun.}$ Sgr A*, its electromagnetic counterpart, currently appears as an extremely weak source with a luminosity L $10^{-9}$ $L_{Edd}$. The lowest known Eddington ratio BH. However, it was not always so; traces of “glorious” active periods can be found in the surrounding medium. We review here our current view of the X-ray emission from the Galactic Center and its environment, and the expected signatures of a past flare. We discuss the history of Sgr A*s past activity and its impact on the surrounding medium.

**Lorena Hernández García (Instituto de Astrofísica de Andalucía)**

**Spectral and flux X-ray variability in LINER nuclei**

One of the most important features in active galactic nuclei (AGN) is the variability of their emission. Variability has been discovered at X-rays, UV, or radio frequencies in time scales from hours to years. Among AGN family and according to theoretical studies, Low-ionization nuclear emission line region (LINER) nuclei would be variable objects on long time scales. We investigate spectral X-ray variability in LINERs, to understand the nature of these kind of objects, as well as their accretion mechanism. Chandra and XMM-Newton public archives were used to compile X-ray

spectra of seven LINER nuclei in different epochs with time scales of years. To search for variability we fit all the spectra from the same object with a set of models, in order to identify the parameters responsible for the variability pattern. This identification gave us clues on the nature of the observed and intrinsic variations. We also analyzed the light curves in order to search for short time (from hours to days) scale variability. Whenever possible, UV variability was also studied. We found spectral variability in five objects, with variations mostly related to hard energies (2-10 keV). These variations were due to changes related to the absorber and/or intrinsic variations of the source. These variations were within years. Variations along each observation were not found from the analysis of the light curves. Our analysis confirm the previously reported anticorrelation between the X-ray spectral index and the Eddington ratio, and also the correlation between the X-ray to UV flux ratio and the Eddington ratio. These results support an Advection Dominated Accretion Flow (ADAF) as the accretion mechanism in LINERs.

**Simona Soldi (APC, Paris, France)**
**Long-term variability of AGN at hard X-rays**
The global variability properties of AGN at the highest energy X-rays have been poorly studied up to now. Swift/BAT offers the unique opportunity to observe a large number of AGN on different time scales in the hard X-ray band above 15 keV. We present here a sample of 110 bright AGN from the 58-month BAT survey, whose variability characteristics were studied as a function of some basic AGN properties, such as the AGN class, luminosity and black hole mass. This represents the largest sample to date for which such a study has been carried out. The blazars in the sample show larger variability than the radio quiet objects, while the radio galaxies exhibit intermediate properties between blazars and Seyfert galaxies. Within the Seyfert class, Seyfert 1.5â€“2 show only slightly larger variability than Seyfert 1, and the three Narrow Line Seyfert 1 of the sample are on average less variable than their broad line equivalent. We do not find any significant correlation between the amplitude of the variations and hard X-ray luminosity or black hole mass, while harder sources are found to be more variable than objects with steeper hard X-ray spectra. Comparing our results on Seyfert galaxies with observations at energies below 10 keV, we find significant differences, some likely resulting from the different time scales probed in these energy bands, and other (e.g. the lack of anti-correlation between variability and black hole mass) possibly suggesting a different physical origin of the variability below and above 10 keV.

**Tomas Pechacek (Astronomical Institute of the Academy of Sciences of the Czech Republic)**
**Detectability of the orbital modulation in AGN light-curves.**
We have simulated a synthetic light-curves produced by the inner parts of an inhomogeneous black-hole accretion disc illuminated by a compact corona. Under a specific conditions the periodic modulation due to the orbital motion of the disc may give rise to a "peak" in the power spectral density. In my talk I will present a results concerning detectability of this effect in the AGN light-curves.

*Tuesday 21-5*
*Session: X-ray flux and spectral variability II*

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**Review: Guido Risaliti**
**Absorption variability in AGNs: from pc-scale tori to BLR clouds**
Time-resolved spectroscopy and multiple observations of nearby AGNs, performed in the last ~10 years with the main X-ray observatories have shown that absorption variability is common among AGN, on time scales from years down to a few hours. I will review the observational evidence for this phenomenon, and discuss how it can be used as a tool to investigate the structure of the circumnuclear medium of AGNs, to determine the intrinsic emission of the absorbed ones, and to disentangle absorption effects from relativistic distortions in their hard X-ray spectra.

**Sanfrutos Carreras (CAB / CSIC-INTA)**
**A partial eclipse by a BLR cloud in the NLS1 galaxy SWIFT J2127.4+5654**
The overall X-ray spectrum of the NLS1 Swift J2127.4+5654 can be interpreted as a combination of a primary power-law-like continuum and reflection off the inner accretion disc, affected by Galactic and intrinsic absorption. We present results from a spectral variability analysis of the source during a long XMM-Newton observation. We reveal large spectral variations that can be attributed to a partial eclipse of the X-ray source by intervening low-ionization/cold gas. Our analysis enables us to infer the size, velocity, location, and density of the absorbing gas with good accuracy. All of the inferred quantities concur to identify the obscuring gas with one single cloud associated with the Broad-Line-Region of Swift J2127.4+5654.

**Gulab Dewangan (Inter University Centre for Astronomy & Astrophysics)**
**Broadband X-ray Spectral Variability of AGN : Complex absorption or intrinsic variations?**
Broadband Spectra of some AGN have been described to be affected both by Complex partial covering absorption and Compton reflection. We have studied broadband spectral variability of NGC1365 and 1H0419-577 to investigate the reality of neutral partial covering absorption and the intrinsic variability of the central engine. We show that the dominant spectral variability of NGC1365 is due to the primary continuum and not due to the partially covering absorption. We also present variability of the Compton reflection emission that cannot be easily explained by the simple light bending model.

**Review: M. Paolillo (University Federico II of Naples)**
**AGN variability in X-ray surveys**
Although X-ray surveys are not the ideal tool to study AGN variability, they provide the opportunity to study large statistical samples of AGNs and thus to extend the results obtained for small samples of nearby sources to the overall AGN population. I will review some of the results obtained in recent years using serendipitous samples assembled from large and/or deep surveys, which allow to study the variability properties of AGNs out to large reshifts. Such works have tried to link AGN variability to obscuration, accretion rates, BH mass and the cosmological evolution of such properties with debated and often contrasting results. I will review the difficulties in measuring variability properties from sparsely sampled lightcurves and investigate the possibilities offered by future surveys.

**Giorgio Lanzuisi (National Observatory of Athens)**
**AGN X-ray variability in XMM-COSMOS**
We took advantage of the observations carried out by XMM-Newton in the COSMOS field during 3.5 years, to study the variability of a large sample of AGN (1058 sources), showing a large range of redshift (0.3<3) and X-ray luminosity ($10^{42}$<$10^{45.3}$). The V parameter was used to asses our ability to measure with good confidence the variability, given the quality of the data available, for each source. The Normalized Excess Variance (sigma^2) was then used to obtain a quantitative measure of the variability, and to study the dependencies with other quantities such as $L_X$, z, BH mass, Eddington ratio. The well known anti-correlation between sigma^2 and $L_X$ is observed also in our sample. Thanks to the unprecedented size and z-$L_X$ coverage of our sample, we are able to observe this anti-correlation in 3 redshift bins. The slopes are similar but for a given luminosity range the typical $sigma^2$ is higher at higher redshifts. No correlation instead is found directly between $sigma^2$ and redshift. We do not find any correlation of sigma^2 with the BH mass. This is in agreement with the fact that we are sampling very long time scales ($10^2$-$10^3$ days rest frame), i.e. the flat part of the PSD for our sources. Finally we find a (weak) anti-correlation with the Eddington ratio.

**Ohad Shemmer (University of North Texas)**
**Exploratory X-ray Monitoring of High-Redshift Radio-Quiet Quasars**
I will present initial results from an exploratory X-ray monitoring of luminous, high redshift radio-quiet quasars (RQQs). This project consists of two groups of RQQs: 1) four sources at z=4.2 monitored by Chandra, and 2) three sources at z=2 monitored by Swift. The two groups have matched luminosities to disentangle the strong z-L dependence. The prime goal of this project is to test claims that quasars were more X-ray variable in the early universe with implications for evolution scenarios of the central engine in active galactic nuclei. The X-ray monitoring is also supported by near-simultaneousoptical monitoring from the ground in order to search for potential correlated optical-X-ray variations. The data will provide basic assessments of variability amplitudes and timescales that will allow planning of more ambitious and systematic X-ray monitoring of such distant RQQs in the future.

## POSTERS FOR SESSIONS 1 + 2

**Elena Racero (Universidad Complutense de Madrid)**
**Broadband Long-Term Variability of VHE Blazars: the case of Mrk421**
In recent years, more and more focus has been placed in broadband studies of blazars as a way to understand the mechanisms responsible for the acceleration of ultra-relativistic particles in these objects. The proposed work aims at addressing these questions by studying the long-term lightcurve of TeV Blazars by putting together archive multiwavelength data of a small sample of TeV Blazars. The study will focus on variability studies over different timescales and the dependence of this variability with parameters such as flux and energy. This work is still in progress, and ultimately, the aim is to provide a systematic study of the variability of Blazars by first applying statistical tools to the case of the TeV Blazar Mrk421, and then by further extending this work to other Blazars in order to infer their physical properties from a statistical context.

**Shruti Tripathi (IUCAA)**
**X-ray variability of AGN**
We discuss and present results of XMM-Newton and Suzaku observations of few AGN to understand the variability characteristics.

**Samuel Connolly (University of Southampton)**
**The Long Term X-Ray Spectral Variability of NGC1365 with SWIFT**
We present long-term spectral variability in SWIFT data of the Seyfert galaxy NGC1365. The data cover both a large time period (over six years) and a very wide flux range. The spectra have been fitted using a variety of models, in order to discover the nature of and reasons for the observed variation. It has been found that variation in the degree of absorption is the most likely cause of spectral changes. The primary cause of the variation in absorption is found to be most likely to be due to changes in thecolumn density of the absorbing material; changes in the ionisation state of the absorbing material alone are found to be insufficient to account for the spectral changes observed. Furthermore, spectral fits seem to show that the degree of absorption decreases with increasing source flux, implying a link between these parameters.

**Yi-Hao Su (Institute of Astronomy, National Central University, Taiwan)**
**Characterizing the Time-Frequency Properties of the 5 mHz Quasi-Periodic Oscillation in Swift J1644+57**
We present the results of Lomb-Scargle spectrograms of the ~5 mHz quasi-periodic oscillation (QPO) around the supermassive black hole in Swift J1644+57. The resultant spectrograms demonstrate that the QPO is composed of a series of intermittent signals between 4Hz and 6Hz with life-time less than a few thousand seconds. Comparing with a low frequency QPO in the black hole binary XTE J1550-564, we conclude that the intermittent feature of both QPOs rules out interpretations of continual frequency modulation.

**Beatriz Agís-González (Centro de Astrobiología, INTA-CSIC)**
**Monitoring of the X-ray absorption variability of ESO 362-G018**
We present results from an X-ray monitoring campaign of the Seyfert 1 galaxy ESO 362-G18. The source was observed twice with Swift on October and November 2005. The Swift observations are consistent with a rather typical AGN spectral shape modified by absorption which is most likely only partially covering the source. A short XMM-Newton observation performed 2 months later revealed a very significant increase of the absorbing column density and covering fraction. We have then monitored the source with one further long XMM-Newton exposure and 5 short Chandra pointings in 2010 to unveil the absorber's properties and variability timescales from kiloseconds to years. We report here results from the analysis of the available X-ray observations of the source and discuss them in the framework of AGN absorption variability models.

*Session3: Outflows and SED variability*

**Review: Niel Brandt (Penn-State University)**
**Variability as a Probe of Quasar Winds: Multi-Year UV/X-ray Observations of Broad Absorption Line and Related Quasars**
Quasar winds are key parts of the nuclear environment, likely assisting mass accretion and providing feedback into typical massive galaxies. They are most directly observed via prominent absorption in the UV and X-ray bands. I will review how variability of these absorption signatures is giving insights into the winds of Broad Absorption Line (BAL) and related quasars. UV absorption studies are now probing, in significant detail and with large samples (hundreds-to-thousands of objects), the dynamics of quasar winds on multi-year rest-frame timescales; such timescales are sufficient to allow significant physical rearrangement and accretion-disk rotation to occur. Measured variations constrain BAL disappearance and emergence, BAL lifetimes, the modes of multi-year BAL variability, and BAL acceleration. X-ray absorption variability studies, while currently providing less detail, probe the "shielding gas" thought crucial for wind formation. Variations of this shielding gas may drive some of the more exceptional examples of UV absorption variability.

**Smita Mathur (The Ohio State University)**
**Probing AGN outflows with variability**
Outflows allow us to probe circumnuclear environment of AGNs and also provide possible agents of feedback. Discoveries of relativistic outflows are exciting in this regard, particularly in AGNs with Seyfert-like luminosity.I will discuss theoretical challenges posed by observations of outflows and future observations that will inform the theory, including short time-scale continuum and spectral variability.

**Nicholas Higginbottom (University of Southampton)**
**Simulating the UV spectra of BALQSOs with a biconical disk wind model**
Outflows are a fundamental part of understanding the structure of AGN and their interactions with both the host galaxy, and their local extra galactic environment. In addition to radio jets, there is increasing evidence for the existence of disk winds in AGN, most compellingly in the case of broad absorption line quasars (BALQSOs). Such winds have also been suggested as the source of the broad emission line region, narrow absorption line region and even the narrow emission line region. Hydrodynamic simulations of such winds have demonstrated that they are likely to have time varying structure which will affect both absorption and emission features.Given the potential importance of this phenomenon for understanding AGN variability, as well as the broader issues of AGN unification and feedback, a proper understanding of disk winds in the AGN context is vital. Extensive modeling of the effect of such flows on the X-ray spectrum of AGN has already been carried out, and we present initial results of a complementary project modeling the UV features of BALQSOs. Here we describe our attempt to model the spectra of BALQSOs assuming a bi-conical wind emerging from the accretion disk. We are able to produce spectra that qualitatively resemble the spectra of BALQSOs. Our simulations provide insight into the physical conditions required to produce BALQSOs and demonstrates the need for significant mass loss in disk winds in order to reproduce the observed spectral features of AGN.

**Francesco Gabriele Saturni (Università di Roma "La Sapienza")**
**Variability of the CIV absorption in APM08279+5255**
Broad Absorption Line (BAL) variability potentially represents a powerful tool to investigate the physical nature and the structure of gas outflows in active galactic nuclei. Most existing BAL variability studies rely on observations taken at a few epochs for samples of tens of BAL QSOs. In the present study we present the first "monitoring" of a single object, APM 08279+5255, which has been observed with the 2.8 m telescope at the Asiago Observatory more than 20 times since 2003. All available spectra from the literature have also been analysed, including two high resolution spectra, from Keck and HST respectively, extending the time interval from 1998 to 2012. A remarkable stability of the shape of the absorption profile is found. At the same time significant variations of the equivalent width are observed. These results suggest that changes in the ionisation and excitation state of the gas are causing opacity changes. A correlation of the BAL equivalent width with the QSO luminosity is found for the first time.

**Suvi Gezari (University of Maryland)**
**Transient Accretion Events from the Tidal Disruption of Stars**
It was first proposed by theorists in the late 1970's that an inevitable consequence of a massive black hole lurking in the center of a galaxy is that stars will pass close enough to the black hole to be ripped apart by its extreme tidal forces and consumed. Rees (1988) suggested that the luminous flare of radiation from the accretion of the bound tidal debris could be used as a signpost for an otherwise dormant and undetectable black hole. The first observational tidal disruption event candidates emerged in the late 1990's from an archival search of the ROSAT All-Sky Survey, in the form of luminous soft X-ray outbursts from several otherwise inactive galaxies. Since then, about a dozen tidal disruption event candidates have been discovered across the electromagnetic spectrum. I will review these candidates, and conclude with the promising detection rates of the next generation of time domain surveys, and how large samples of these events can be used as transient probes of accretion physics, jet formation, and black hole demographics.

**Richard Saxton (XMM SOC / ESAC)**
**Identifying state-change AGN from massive X-ray variability**
After a decade of slewing over the sky, XMM-Newton has discovered 6 galaxies which have increased their soft X-ray output by more than two orders of magnitude since the ROSAT all-sky survey. Three of these appear to be tidal disruption events while three show signs of persistent AGN activity. We focus here on GSN069, a galaxy hosting a $10^6$ m/solar black hole, which is 240 times brighter now than it was 16 years ago. The source is currently in a steady, super-soft state with no emission over 1 keV; it can be well fit with a pure accretion-disk model of kT~60 eV. Optically it has the spectrum of a 'true' Sy II galaxy, with no broad lines and no signs of appreciable intrinsic absorption. This is unusual for an AGN with $L_{bol}$~8x10^43 and an estimated accretion rate ~0.5 $m_{edd}$. A clue may come from the historical $L_{bol}$, as estimated from the [OIII] emission, which is 20-30 times lower, strengthening the argument that GSN 069 has recently changed its accretion state. From our survey we find that state-change AGN are apparently rarer objects than tidal disruption events, which themselves occur only once per ~$10^5$ years for a typical galaxy. However, we note that GSN 069 is only found from its extreme X-ray variability because it has a low BH mass; AGN in a similar state with M_BH=$10^{7-8}$ would be undetectable and appear to first order as compton-thick AGN. From the demography of BH masses in our survey we can make the first estimates of the duty cycle of the super-soft state in AGN.

**Omar Tibolla (ITPA, Würzburg University)**

**The Narrow Line Seyfert 1 galaxies: a rosetta stone for the jet/disk paradigm.**

Narrow-Line Seyfert 1 galaxies (NLSy1s) have been established as a new class of gamma-ray emitting AGN with relatively low black hole masses, but near-Eddington accretion rates. Other extragalactic gamma-ray source observed so far such as Flat Spectrum Radio Quasars, Radio Galaxies, and BL Lacertae Objects generally exhibit much higher black hole masses and, in the case of of BL Lacs and Radio Galaxies, much lower accretions rates. In order to be able to study the disk/jet coupling and overall which condition take to the emerging of the jet over the disk spectrum, it is mandatory to perform simultaneous optical, UV, soft X-ray, hard X-ray and gamma-ray observations. Moreover, one of the most-well-studied gamma-ray bright NLSy1s, 1H 0323+342 (subject of a deep multifrequency campaign in 2013), exhibits also very prominent spectral variability.

*Wednesday 22-5*
*Session4: The UV-X ray connection: correlations*

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**F. Vagnetti (Università di Roma Tor Vergata)**
**UV/X-ray ratio and its variability in AGNs**
Variability of active galactic nuclei in the X-ray and optical/UV bands affects the measurement of the alpha_ox spectral index, contributing part of the dispersion around the well-known alpha_ox-$L_{UV}$ anti-correlation. Structure function analyses on various samples based on simultaneous X-ray/UV observations indicate strong intrinsic variability of alpha_ox, which contributes between 30% and 50% of the total dispersion. In some cases with better temporal sampling, like the XMM deep survey in the CDF-S, it is also possible to investigate alpha_ox variability for individual so urces, as well as their X-ray/UV correlations.

**William Alston (University of Leicester)**
**Probing the inner regions of the highly-variable Seyfert 1, NGC 4051**
AGN are powered by accretion through a disc onto a supermassive black hole. Dominated by UV emission from the disc, their broad emission spectrum requires multiple emission components, including thermal and non-thermal mechanisms. NGC 4051 is a narrow line Seyfert 1 galaxy that displays large amplitude variability in both the UV and X-rays. Here we use a series of 15 XMM-Newton observations, plus 70 Swift snapshots, taken over 45 days in 2009, to analyse of the variability in the UV and X-ray bands. We investigate the correlated UV and X-ray emission on both ~hours and ~day s timescales, to reveal the causal connections and location of the two emission regions. We also present the results the Fourier-frequency dependent reverberation-delays seen in the X-rays, as a function of source flux. We have modelled the delays using analytical transfer functions, and find a systematic changes with source flux. We discuss the interpretation of these results in terms of the two competing ideas for the origins of X-ray time delays, and the implications of this flux-dependence for other studies.

**Paulina Lira (Universidad de Chile)**
**Variability in NGC3783, MR2251-178 and MCG-6-30-15: 5 years of X-ray, optical and NIR monitoring.**
Results will be presented from a multiwavelength, 5 year monitoring of 3 nearby AGN. The targets are characterized by very different Black Hole (BH) masses and as a result their light curves show clear differences in the variability amplitudes and time scales. There is also evidence that the combination of the BH masses and accretion rates result in a different temperature profile of the accretion disk, with MCG-6-30-15 corresponding to a 'hot' disk and MR2251-178 to a 'cold' disk.

## POSTERS FOR SESSIONS 3+4

**Conor Wildy (University of Leicester)**
**Spectral Variability in Broad Absorption Line Quasars**
Approximately 10-20% of quasars show evidence for large scale, high velocity outflows in the form of blue shifted broad absorption lines (BALs). In previous studies, variability has been recorded on time scales ranging from a few days to several years. Understanding the causes of variability, such as ionization changes or movement of gas along the line of sight to the emission region, can provide

insights into the physics and geometry of the outflows. Knowledge of outflow structure and kinematics is important due to the emerging awareness of relationships between AGN accret ion and the properties of the host galaxy. We present the results of an investigation into Si IV and C IV BAL variability in a sample of 50 quasars. Measurements used the novel technique of reconstructing the un-absorbed quasar spectra using non-negative matrix factorisation, a blind source separation technique. Variability could therefore be quantified over low velocity BAL regions, where the absorption overlaps with the transition's emission line or, for high velocity Si IV BALs, where it overlaps with C II and O I emission lines. After examining the sample's variability over several indicators we find trends that are consistent with studies which include only detached BALs (which do not overlap emission features).

**Cosmos Dumba (Georg-August-Universitadt-Gottingen)**
**Probing the Accretion Disk Winds of AGN**
The Broad Line Region of Active Galactic Nuclei is characterized by Broad Emission Lines in their Optical Spectra. However the properties of this line emitting gas has had a dramatic change from being taken as a dense gas with a small volume filling factor to being taken as originating from an outflow of material from the accretion disk. This was confirmed from the broad blue shifted absorption lines seen in the resonance transitions of CIV, OVI, Ne VIII and Lyman alpha. This wind produces emission lines at all viewing angles, which contribute significantly to the formation of the Broad emission Lines observed in Broad Line AGN. We shall probe the accretion disk wind using the emission line profiles. The asymmetry of emission line profiles is an indicator of the accretion disk wind. This asymmetry of the broad and narrow emission line profiles will be measured 'by hand' in velocity space. This study is based on many hundreds of SDSS spectra - starting with low-redshift high S/N spectra. In addition, the line shift of the broad line centers relative to the systemic velocity of the narrow lines shall be investigated. We shall answer such questions as, how strong is the asymmetry (by flipping the profiles) of the broad/narrow lines (in percent)? The asymmetry index (e.g. AI20) will be measured at heights of 0, 10, 20, 30, 50, 80 percent. What is e.g. the Kurtosis (R20, 50)? It is therefore worthwhile to study what the asymmetry index as a function of luminosity, ionization degree, radio flux, line width (FWHM) is.

**Ece Kilerci-Eser (DARK Cosmology Center, Denmark)**
**Simultaneous SEDs of Nearby Seyferts**
Active Galactic Nuclei (AGN) are powered by the interaction between the supermassive black hole residing at their centers and the surrounding accretion. The optical to X-rays continuum luminosity is generated by the accretion disk. AGNs show variations in flux at all wavelengths, which affect the spectral energy distributions (SEDs) and the bolometric luminosities. The details of the SED and its shape provide important constraints to theoretical accretion disk models and to the accretion processes that control the growth and evolution of the central black hole and its host galaxy. We construct simultaneous SEDs for 7 nearby Seyfert 1 galaxies using contemporaneous optical, ultraviolet (UV) and X–ray data at multiple epochs and we investigate the time dependence of these SED-related parameters in individual objects.

**Marco Antonucci (Università di Roma Tor Vergata)**
**Alpha_ox variability in a composite sample of active galactic nuclei**
Variability, both in X-ray and optical/UV, affects the well-known anti-correlation between the alpha_ox spectral index and the UV luminosity of active galactic nuclei, contributing part of the dispersion around the average correlation (intra-source dispersion), in addition to the intrinsic differences in the average alpha_ox values from source to source (inter-source dispersion). Samples with simultaneous X-ray and UV measurements allow to evaluate such contributions, and to

characterise the intrinsic alpha_ox variability. We present the ensemble structure function analysis of a composite sample constituted by sources observed by XMM-Newton and Swift.

**Gabriele Bruni (IRA-INAF)**
**Near-infrared spectroscopy of radio-loud broad absorption-line quasars**
Quasar outflows are manifested most spectacularly as broad absorption-lines (BALs) in the blue wings of some prominent emission lines (e.g. C IV and Mg II) in 10–20% of optically-selected quasars, tracing outflow velocities up to ~0.2 c (Hewett & Foltz 2003). Becker et al. (2001) estimated that BAL QSOs are four times less common amongst quasars with log R∗ > 2 than amongst quasars with log(R*) < 1 ( where R∗ is the k-corrected ratio S(5GHz)/S(B)).

**Michele Perna (Università di Roma La Sapienza, Roma, Italy)**
**An experiment on cross-correlation lags from simultaneous XMM-newton X-ray and UV observations in the CDFS**
We extract a small sample of quasars with simultaneous X-ray and optical/UV observations in ~30 epochs in the time interval 2001-2010, from the XMM deep survey in the CDFS. We present preliminary results indicating for one of the sources a lag of ~12 days rest-frame for the UV with respect to the X-ray variations, comparing different cross-correlation techniques.

*Session5: Variability on the optical band: Reverberation studies*

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**Review: Bradley Peterson (Ohio State University)**
**Reverberation Mapping of AGNs**
I will review recent progress in reverberation mapping, including newly acquired velocity-delay maps and progress toward measuring black hole masses.

**Gisella De Rosa (Ohio State University)**
**2012 Reverberation Mapping Campaign**
I will present results from our latest reverberation mapping program, carried out over January-April 2012. During the 120 days of the campaign, we collected both spectroscopic and photometric data for nine Seyfert 1 galaxies from various observatories. We have obtained high sampling-rate light curves of the Hbeta emission line and of the AGN continuum at 5100 Ang for seven AGNs: NGC 3227, NGC 3516, NGC 4151, NGC 5548, Mrk 374, Mrk 478, Mrk 704. I will discuss the analysis of the light curves and the derived time lags between continuum and line emission variation as well as the estimated black hole masses.

**Anna Pancoast (University of California Santa Barbara)**
**LAMP 2008 and 2011: Dynamical Modeling of the Broad Line Region Using Reverberation Mapping Data**
We present dynamical modeling of the broad line region (BLR) using high-quality reverberation mapping data taken as part of the Lick AGN Monitoring Projects (LAMP) 2008 and 2011. While traditional reverberation mapping analysis yields estimates of the mean radius of the BLR, cT and black hole mass, M = (f v^2 cT)/G, direct modeling of reverberation mapping data allows us to constrain more detailed features of the BLR. In our geometric and dynamical model, we constrain the shape and inclination angle of the BLR with respect to the observer's line of sight. In addition to geometric constraints, we also obtain an independent estimate of the black hole mass that does not depend upon the normalizing factor, f, required by traditional analysis. By comparing our independent estimate of the black hole mass to the traditional estimate, we can recover the normalizing factor for individual AGNs.

**Michael Ramolla (Ruhr-Universität Bochum)**
**Photometric reverberation mapping: Determining broad-line region size and geometry**
We present the results of a photometric reverberation mapping campaign performed with robotic telescopes in the Atacama Desert. Through the combination of broad- and suitable narrow-band filters we can determine the size and geometry of the broad-line emitting region (BLR) by measuring the time delay between the variability of the continuum and a Balmer line. We use the flux variation gradient method to separate the host galaxy contribution from that of the active galactic nucleus (AGN), and to calculate the 5100Å luminosity of the AGN. Thus, our photometric method provide s an efficient way to probe the BLR-radius-AGN-luminosity relationship.

**Michael Goad (University of Leicester)**
**Geometric dilution and the slope of the emission-line response**
Photoionisation models suggest that the marginal response of the emission-lines to continuum variations can place additional constraints upon the physical properties of the broad-line region gas.

However, the measured line response is complicated by geometric effects which may act to dilute it. Here, we re-assess the accuracy of measurements of the recovered line response through detailed numerical simulations.

**Nick Devereux (Embry-Riddle University)**
**The Size, Structure & Ionization of the Broad Line Region in NGC 3227 & NGC 4051.**
NGC 3227 and NGC 4051 are two well known time-variable Seyfert 1 AGNs that have been the target of many reverberation mapping campaigns. For these two AGNs, the time-variable component of the broad Balmer line flux, Fvar, is typically ~10% of the total line flux. Thus, ~90% of the broad line flux is not time-variable, at least on the time-scales that they have been monitored. Consequently, one can anticipate that reverberation mapping must be measuring variability at the inner radius of a much larger volume of partially ionized gas. This anticipated result is now demonstrated quantitatively using a new analysis technique that reveals the size, structure and ionization of the broad line region. I will discuss recently published results for NGC 3227 (Devereux 2013, ApJ 764, 79) and recently submitted results for NGC 4051. In both cases, the reverberation radius coincides with the inner radius of a much larger region of partially ionized, inflowing gas. Furthermore, photoionization modeling reveals that in both AGNs, the reverberation radius coincides with a transition region; from partially ionized to fully ionized H gas, as the AGN is approached. Collectively, these results have important broader implications for BH masses estimated using reverberation radii and the structure of the broad line region inferred from velocity-delay maps.

**Stephen Rafter (Israeli Institute of Technology, the Technion)**
**Photometric Reverberation Mapping of NGC 4395**
We present results testing a new approach to photometric reverberation mapping on the nearby low luminosity AGN in NGC 4395. We find a time lag consistent with previous studies and estimate the black hole mass to $<10^5$ solar masses.

**Shai Kaspi (Israeli Institute of Technology, the Technion)**
**Reverberation studies of luminous, high-z quasars**
In the past three decades reverberation mapping has been used to measurethe size of the BLR and the black hole mass of about 50 AGNs. However, the luminosity of these AGNs is limited to the range of $10^{42}$ to $10^{46}$ ergs/sec (monochromatic luminosity at 5100A), while there are AGNs as bright as $10^{49}$ ergs/sec. Thus, reverberation mapping studies are missing three orders of magnitude in luminosity. I will describe the attempts done over the past years to carry out reverberation mapping studies of luminous high red-shift quasars in that missing luminosity range, the difficulties such attempts had encountered, and their results. I will also discuss prospects for future studies to enlarge both the luminosity range and the number of AGNs with reverberation mapping measurements.

**Michele Perna (Università di Roma La Sapienza, Roma, Italy)**
**Reverberation mapping of the quasar PG 1247+268**
Virial estimates of the black hole mass in the center of AGNs, derived from single-epoch observations of luminosity and emission line widths, are now available for several thousands of objects at all redshifts and luminosities, so that studies of the cosmological evolution of the AGN mass function are becoming possible. These estimates are based on the empirical luminosity-size relation measured through reverberation mapping at low redshifts and luminosities. For this reason the spectrophotometric monitoring of 4 luminous quasars was started in 2003, with the 1.8 m telescope of the Asiago Observatory. To measure the reverberation time lag we adopt a method, recently introduced by Zu et al. (2011), which takes advantage of the available statistical information on variability autocorrelation and makes simple assumptions on the continuum-

emission line transfer function. We present the estimate of the broad line region size and black hole mass for the quasar PG 1247+267, which is the most luminous object with reverberation measures to date. Measures with both CIV and CIII] emission lines provide consistent results. A possible flattening of the size-luminosity relation at high luminosity is suggested.

## POSTERS FOR SESSION 5

**Rumen Bachev (Institute of Astronomy, BAS, Bulgaria)**
**Photometric reverberation mapping of Mrk 279**
Using standard broad-band VRI photometry we were able to discriminate the variations of the broad hydrogen alpha line from the continuum variations for the active galaxy Mrk 279. Cross-correlating both light curves enabled us to determine the time lag of the broad line variations behind the continuum and thus to determine the BLR size (about 8 light days). Our results are rather consistent with the spectroscopic reverberation mapping results (about 12 days). This study is a part of an ambitious program to perform photometric reverberation mapping and determine BLR sizes (respectively - the central black hole masses) for more that 100 nearby AGN.

**Emily Heaton (Embry-Riddle Aeronautical University )**
**The Broad Line Region in NGC 4051**
Adopting a spherically symmetric steady-state ballistic inflow as the kinematic model for the gas distribution responsible for producing the H-alpha emission line and a central black hole (BH) mass of 1.7 x$10^6$ M_sun, determined from prior reverberation mapping, leads to the following dimensions for the size of the broad line region (BLR) in NGC 4051; an inner radius ~3 lt-days and a lower limit to the outer radius ~ 475 lt-days. Thus, the previously determined reverberation size for the BLR marks just the inner radius of a much larger volume of ionized gas. Consequently, according to our interpretation, the reverberation radius uniquely defines the full width at zero intensity of the broad H-alpha emission line, which suggests a new virial product for computing BH masses. Collectively, these results have important implications for BH masses estimated using reverberation radii and the structure of the BLR inferred from velocity-delay maps. See arXiv:1302.7049 for more details.

**Encarni Romero Colmenero (SAAO/SALT)**
**Preliminary results from reverberation mapping of MCG -6-30-15 and PG0934+013**
We present preliminary results of two reverberation mapping campaigns carried out on two Seyfert 1 galaxies, namely MCG -6-30-15 and PG0934+013, using spectroscopy obtained from the Southern African Large Telescope (SALT) and optical monitoring via OGLE, SAAO 1m and LCOGT telescopes.

*Session 6: Variability on the optical band: the continuum I*

**Review: George Djorgovsky (California Institute of Technology)**
**Exploring the Time Domain and AGN With Synoptic Sky Surveys**
A new generation of synoptic sky surveys that cover large areas of the sky repeatedly, have opened a new exploration space for a time-domain astronomy. I will describe one such survey, CRTS, to illustrate both the scientific potential and the challenges in this arena, with a special focus on the time domain studies of AGN. I will describe some new data mining and analysis ideas that may add substantially to our understanding of AGN and their astrophysical and cosmological uses.

**Richard Edelson (University of Maryland)**
**Optical variability of the Kepler AGN**
Kepler is opening a new era for the study of AGN optical variability, producing light curves with ~0.1% errors (for a ~15th magnitude source), 30 min sampling, >90% duty cycle and durations of years. Our intensive identification program has expanded the number of AGN observed by Kepler from just one in Cycle 1 to many dozens today. Our earlier small survey (Mushotzky et al. 2011, ApJ, 743, L12) measured the first optical power spectral density (PSD) functions for AGN, finding that on timescales of ~6 hr to 1 month, the four Seyfert 1s surveyed had slopes of ~-3, steeper t han seen in the X-rays. It also found a broad correlation between rms variability and flux level.
I will discuss the results for a greatly expanded survey consisting of the 33 Seyfert 1s with Kepler data as of Q15 (the last quarter that will be released before the meeting), comparing variability properties with source parameters derived from our complete set of Lick 3-m spectroscopy. I will also address various complications and solutions with Kepler light curves. Finally I will very briefly (since this conference focuses on radio-quiet AGN) show the short cadence (1 min sampling) light curve for the BL Lac object W2R1926+42, which may be the information-richest AGN light curve ever gathered at any wavelength.

**Regis Cartier (Universidad de Chile)**
**A Full Characterization of Active Galactic Nuclei Optical Variability**
We present photometric and astrometric characterization of the AGN Variability QUEST-La Silla survey. Our goals are to study black hole evolution and selecting AGN's by collecting well-sampled light curves, on day to year timescales to assemble unbiased samples of variable AGN candidates in order to characterize variability selection methods. Additionally, we want to relate AGN variability with fundamental physical parameters. To achieve our goals we nightly observe extragalactic fields, like COSMOS, using the QUEST camera located at the ESO-Schmidt telescope. The telescope has a effective area of ~7.5 square degrees. We began our survey in March 2010 and here we describe our progress and review the photometric and the astrometric quality of the survey. We present AGN light curves for the first two years and test variability selection techniques for known AGNs in the COSMOS field.

*Thursday 20-5*
*Session 7: Variability in the optical band: the continuum II*

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**Review: Omer Blaes (University of California Santa Barbara)**
**Variability in MHD Simulations of Black Hole Accretion Flows**
Considerable theoretical effort has been devoted over the years to large scale simulations of magnetorotational turbulence in black hole accretion flows, in order to try and build physics-based models that can more meaningfully connect with observations, including variability. The full promise of this effort has yet to be realized, however. Simulations of the radiatively inefficient Galactic Center accretion flow are closest to connecting with observations. But accretion flows that produce copious radiation are much more challenging. Still, progress has been made and we now have new insights into the possible structure and dynamics of the flows. I will review recent progress, with a focus on what can and cannot be said about variability.

**Demetra De Cicco (Università degli Studi di Napoli "Federico II")**
**The Search for Active Galactic Nuclei through Optical Variability in the VST Survey of the COSMOS Field**
Active galaxies are characterized by variability on timescales from hours to years depending on the wavelength range of observation. Optical variability has proven to be an effective way of detecting AGNs in imaging surveys, lasting from weeks to years. We tested the use of optical variability to identify active galactic nuclei in the VST multi-epoch survey of the COSMOS field, originally tailored to detect SN events. We present our preliminary sample, discussing the reliability of the method and the nature of our AGN candidates using the multi-wavelength data provided by the COSMOS surveys.

**Mischa Schirmer (Gemini Observatory, Chile )**
**Quasar ionization echoes and 100,000 year baseline AGN light curves**
The recently discovered Green Bean galaxies around radio-quiet type-2 AGN feature ultra-luminous extended emission line regions. They retain a memory of an AGNs' activity over the last 100,000 years, and we can reconstruct the according light curves. In this presentation I will present our demanding observational campaign, and the insight we can gain into SMBH accretion and galaxy evolution.

**Giuliano Giuffrida (ASI Science Data Center, Italy)**
**AGN variability with GAIA**
Gaia, launch planned for September 2013, will continuously scan all the celestial sphere for 5 years, realizing a complete map of the sky up to magnitude G=20. For each object, Gaia will measure the position ( ~ 10 μas accuracy ), and will perform spectrophotometric and spectroscopic observations. The final Gaia catalog will contain about 500000 AGN, 80% will be new detected sources. Here I will describe the mission and the Gaia contribution to AGN science.

**POSTERS FOR SESSION 6+7**

**Angela Sandrinelli (Università dell'Insubria Como, OAB Brera Merate)**
**Long and Short Term Variability of Seven Blazars in Six Near-infrared/optical Bands**
We present the light curves of six BL Lac objects, OJ287, PKS 2155-304, W Comae, PKS 0537-441, PKS 0735+17, PKS 2005-489 and of the Flat Spectrum Radio Quasar PKS 1510-489, as a part

photometric monitoring program in the near-infrared/optical bands started in 2004. All sources are Fermi Blazars. Data were obtained with the REM telescope located at ESO premises of La Silla (Chile). Light curves were gathered in the optical/near-infrared VRIJHK bands from 2005 April to 2012 June. Variability >3 mag is observed in PKS 0537-441, PKS 1510-089 and PKS 2155-304, the largest ranges spanned in the near-infrared. The color intensity plots show rather different morphologies. The spectral energy distributions in general are well fitted by a power law, with some deviations which are more apparent in low states. Some variability episodes during a night interval are well documented for PKS 0537-441 and PKS 2155-304. For the latter source the variability time scale implies a large relativistic beaming factor.

**Kirsten Schnuelle (MPIA Heidelberg)**
**Dust physics in NGC4151**
Using dust reverberation mapping, we monitor the effects of AGN continuum variability on the temperature and covering factor of the circumnuclear dust, in order to study in detail the radial dust profile and to constrain the physical conditions of dust survival and formation in the radiation field of the AGN. Near-infrared multi-band photometry observations were carried out on the nucleus of the Seyfert 1 galaxy NGC 4151 over six epochs from 2010 January - 2010 June, supported by spectroscopic observations, in order to investigate the response of the hot dust to varying accretion disk emission. Our data show that the major part of the hot dust torus reacts with a delayed brightening of roughly 50 days to an increased irradiation from the central source. Moreover, we see no signatures of dust destruction in our data. In bright times, the innermost dust appears to increase in temperature rather than sublimate, suggesting that it is cooler than sublimation temperature and hence located beyond the current sublimation radius. We study the dust morphology by applying a simplified torus model to our data, which points at a radially extended and static distribution as well as a rather flat radial density profile of the innermost, hot dust.

**Tomoki Morokuma (University of Tokyo)**
**Variability Survey for AGN with Optical Wide-Field Imagers**
We show our previous results and future plan of AGN survey with optical wide-field imagers on Kiso 1-m Schmidt telescope and Subaru 8.2-m telescope, especially for low-luminosity AGN.

**Judit Garcia Gonzalez (IFCA: Instituto de Fisica de Cantabria, Spain)**
**Analysis of AGN-candidates selected through variability in SPITZER/MIPS 24micron in the GOODS-South field.**
We present a study of sources showing mid-infrared (MIR) variability using the deepest Spitzer/MIPS 24micron taken in the GOODS-SOUTH field. Our main goal is to select (possibly obscured) Active Galactic Nuclei (AGN) based on dust emission variability. For this purpose, we retrieved from the Spitzer Heritage Archive (SHA) all available data taken by the MIPS instrument at 24micron in GOODS-S. These data come from two different surveys: GOODS and the Guaranteed Time Observer (GTO) observations. We divided the data set in 7 different epochs, with typical time lapses between them of several months. We also divided one epoch into subepochs to study short-time variability. We constructed a sample of bona fide variable sources at 24micron using the $\chi 2$ method, which takes into account the photometric uncertainties, and visually inspecting all candidates to avoid artifacts. A preliminary analysis of their properties indicates that these variable sources lie at intermediate redshifts ($0 < z < 1$), with some of them being mergers.

**Francois Taris (Observatoire de Paris)**
**Optical monitoring of QSOs in the framework of the Gaia space mission**

The astrometric mission Gaia of the European Space Agency is scheduled to be launched in 2013. It will provide an astrometric catalogue of 500000 extragalactic sources that could be the basis of a new optical reference frame after the Hipparcos satellite one. On the other hand, the current International Celestial Reference Frame (ICRF) is based on the observations of extragalactic sources at radio wavelength. The astrometric coordinates of sources in these two reference systems will have roughly the same uncertainty. It is then mandatory to observe a set of common targets a t both optical and radio wavelength to link the ICRF with what could be called the GCRF (Gaia Celestial Reference Frame). This poster presents the set of optical telescopes used to observe the targets chosen for the link of the two reference systems. It also presents some results about optical magnitude monitoring of extragalactic sources suitable for the GCRF-ICRF link. A morphological index is defined and applied to the 5000 images obtained during a first observation campaign.

*Session 8: AGN variability analysis methods*

**Review: Brandon Kelly (University of California, Santa Barbara)**
**Quantifying AGN variability through stochastic modeling of their lightcurves**
I will discuss recently developed techniques for quantifying AGN variability through stochastic modeling of their lightcurves. I will also review some of the important results obtained using this approach over the last few years. I will conclude with open and unanswered questions which provide directions for future work.

**Ciro Donalek (California Institute of Technology)**
**Machine learning techniques in the time domain**
Better and faster technology is increasing the amount of collected data in many scientific fields, all of them requiring a common task: extract knowledge from massive, multi parametric data sets, as rapidly and efficiently possible. In the field of Time Domain Astronomy, Synoptic Sky Surveys are posing several new research challenges, such as identifying unique or unusual classes of objects, real-time and archival classification, decision making (eg, choose the objects worthy of follow-ups with expensive facilities). Most systems today rely on a delayed human judgment and this “manual” approach will simply not scale to the next generation of surveys thus the need of a machine learning approach.Using data sets extracted from the ongoing Catalina Real-Time Transient Surveys (CRTS), I show the results obtained applying machine learning techniques to different astronomical problems (eg, classifying transients on the basis of features describing the light curves, systematic search of CV). Moreover, I'll show a variety of feature selection strategies used to identify the subsets that give the most information.

**Max Anton Kastendieck (Universitat Hamburg)**
**Time series analysis of fragmentary light curves**
Long-term light curves of astrophysical objects are often (naturally) accompanied with gaps in the data. Established methods for calculating the power spectrum of unevenly sampled light curves can be heavily affected by large gaps in the data and instrumental noise. In such a case it is difficult to determine the intrinsic power spectrum density of the flux.A forward-folding method using simulated light curves is presented which is feasible to measure slopes and breaks in the true power spectrum density and to identify periodicities. The methods for calculating the power spectrum are combined with a maximum-likelihood method to estimate the best-fit parameters. The uncertainties on the parameters and the goodness of fit are determined with a Bayesian approach.The performance of the method is demonstrated with simulations and some results obtained with observed light curves are shown.

**POSTER for session 8**

**Chin-Ping Hu (National Central University, Taiwan)**
**An HHT Analysis of the QPO in Active Galactic Nucleus RE J1034+396**
RE J1034+396, a narrow-line Seyfert-1 active galactic nucleus (AGN), is the first example of AGN that shows an almost coherent Quasi-Periodic Oscillation (QPO) in X-ray observation. The spectral behaviors and the timing properties of the QPO were further studied since its discovery. We present our analysis of the QPO in RE J1034+396 based on the Hilbert-Huang transform (HHT). Since the HHT is optimize for the non-stationary and non-linear time series, the QPO is suitable for being analyzed by the HHT. We applied the HHT on the data collected by XMM- Newton in 2007. In contrast to other time-frequency analysis methods, the Hilbert spectrum gives us more detailed

information in both time and frequency domains. Furthermore, the empirical mode decomposition provides us local band-pass filtered data that can be used in the O-C and correlation analysis. We suggested that the QPO is better to be divided into three epochs according to their different periodicities. In addition to the periodicities, the correlations between the QPO periods and the corresponding mean count rates are also different in these three epochs. Finally, the QPO phase-resolved spectral analysis is also applicable based on the phase derived in the HHT. We present here the variation of two spectral components versus the QPO phase.