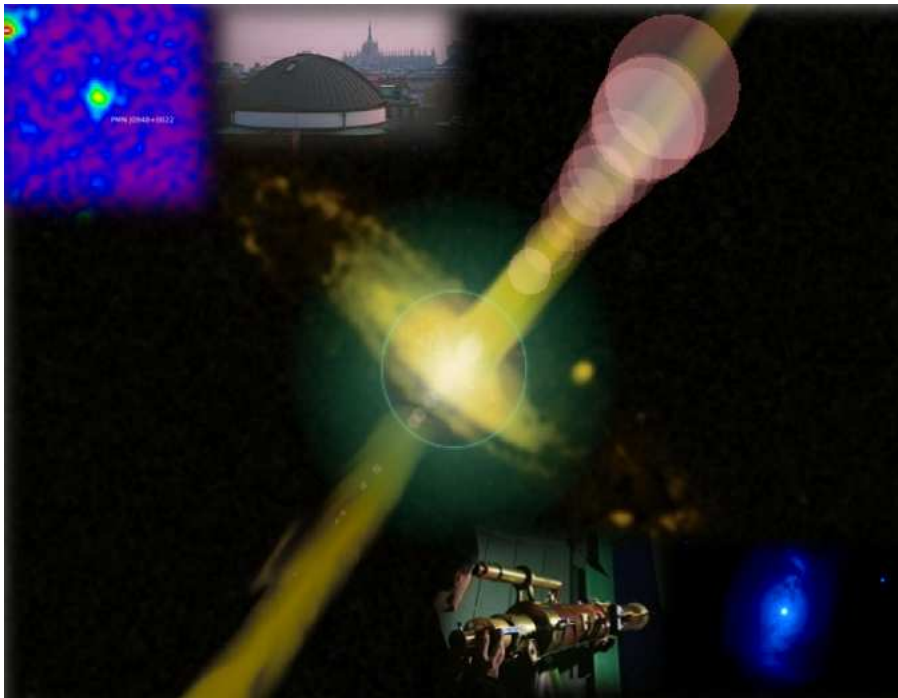




*International Scientific Workshop*

# Narrow-Line Seyfert 1 Galaxies and their place in the Universe



*Milano (Italy), Civic Aquarium Auditorium, 4-6 April 2011*



**Last Updated: April 1, 2011**

SCIENTIFIC ORGANIZING COMMITTEE:

Monica Colpi (Università di Milano Bicocca, Italy)

Luigi Foschini (INAF Osservatorio Astronomico di Brera, Italy, *Chair*)

Luigi Gallo (St. Mary's University, Canada)

Dirk Grupe (Penn State University, USA)

Stefanie Komossa (Max-Planck-Institut für extraterrestrische Physik, Germany)

Karen Leighly (University of Oklahoma, USA)

Smita Mathur (Ohio State University, USA)

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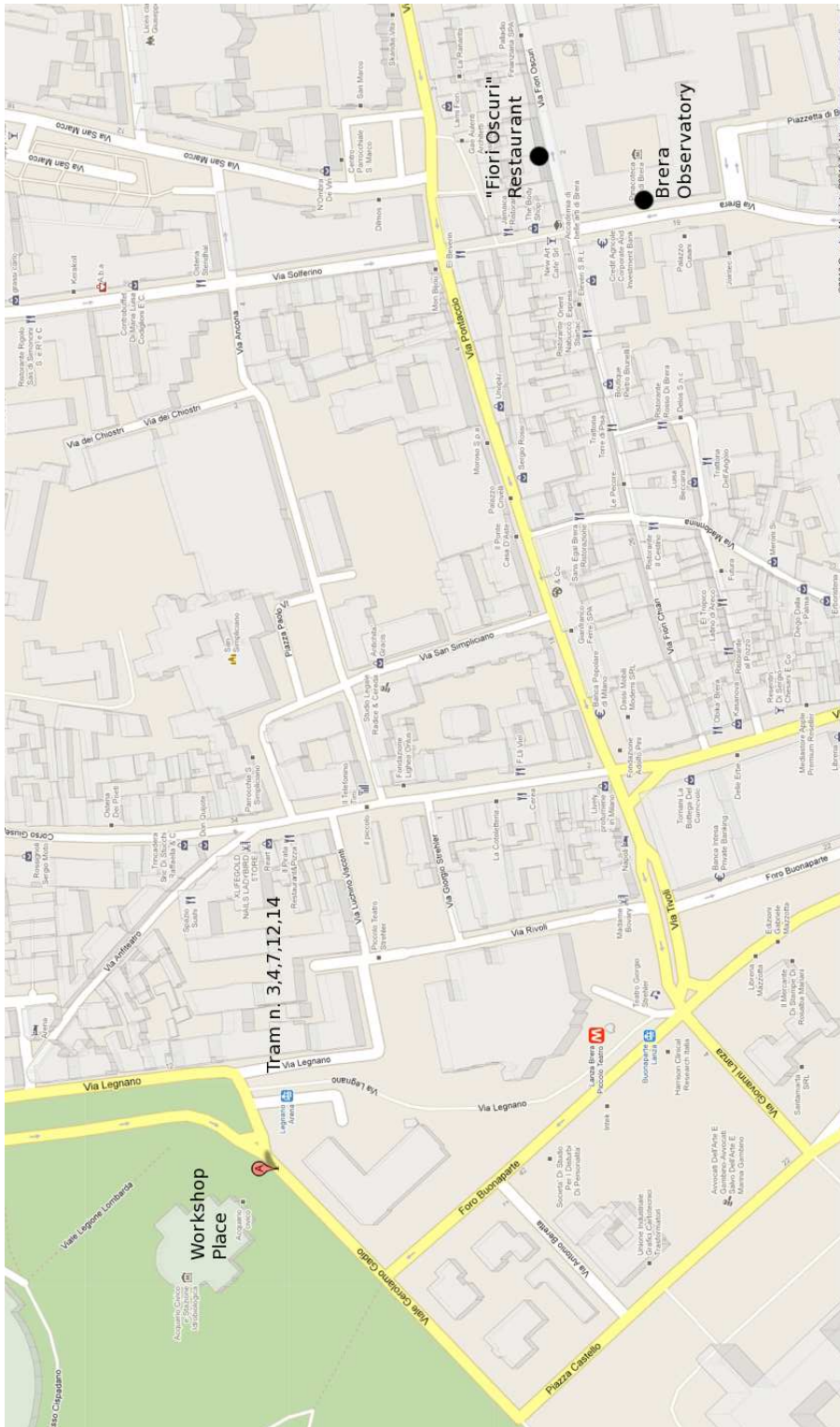
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Narrow-Line Seyfert 1 Galaxies and their place in the Universe



**GENERAL DATA:**

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**How to reach:**

The workshop is held at:

*Auditorium of the Civic Aquarium of Milano  
Viale Gadio 2 (see the map)*

It can be reached by bus (n. 57), tram (3, 4, 7, 12, 14) and metro (line 2/green, stop Lanza).

Useful links on how to reach are available on the web site of the workshop at the link “How to reach”. Just a few straight examples:

- *From Airport Milano Linate:* take the bus n. 73 just at the exit of the terminal. At the end of the line (Piazza San Babila) take the metro line 1/red and exit at stop Cairoli. The Civic Aquarium is at 10 minutes walking.
- *From Airport Milano Malpensa:* you can take one of the several shuttles at the exit of the terminal directed to the Milano Central Railways Station. From there, you can take the metro line 2/green and exit at stop Lanza. You are at a few minutes walking from the workshop place. Otherwise, you can take the train Malpensa Express Ferrovie Nord and arrive at the Cadorna Station. There, you can take the metro line 2/green and exit at stop Lanza.

There is only one type of ticket for bus, tram, and metro. It costs 1 € and it is valid 75 minutes once stamped (including only one travel in metro).

The Civic Aquarium of Milano is also at a few minutes walking from the Brera Palace (via Brera 28, see the map), where is the headquarter of the Astronomical Observatory and the Art Gallery.

**Hotels, Restaurants:**

There are several hotels and restaurants in the Brera area, some of them indicated at the workshop web site under the link “Lodging” (see also the map). Some hotels can offer discounts if you cite the “Osservatorio Astronomico di Brera” in your reservation request (see the workshop web page). A very simple meal (one pasta dish, water, coffee) can cost around 10-15 €.

**Social Dinner:**

The social dinner will be on April 5 at 20:00 at the Restaurant “Fiori Oscuri” (Via Fiori Oscuri 3, see the map).

**ATM (cash withdrawals):**

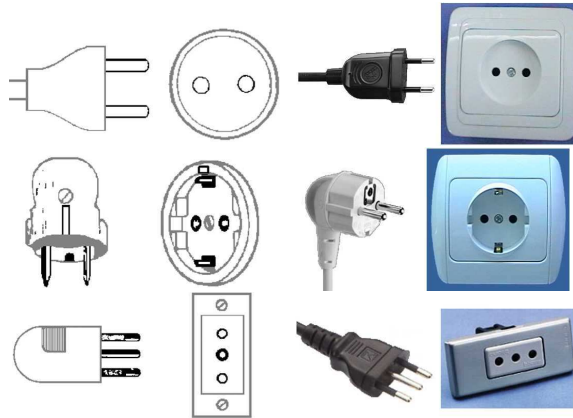
There are several ATM (“bancomat”, in Italian) nearby the Acquarium and Brera (a few are indicated in the map).

**Wireless:**

There will be a wireless network available. More information on how to connect will be given at the registration desk.

**Electric power and plugs:**

In Italy, the power is distributed at 230 V and 50 Hz. Three types of plugs are available (see figure). Please be sure to have the proper adapter and/or transformer.



**How to contact the LOC - Emergency Numbers:**

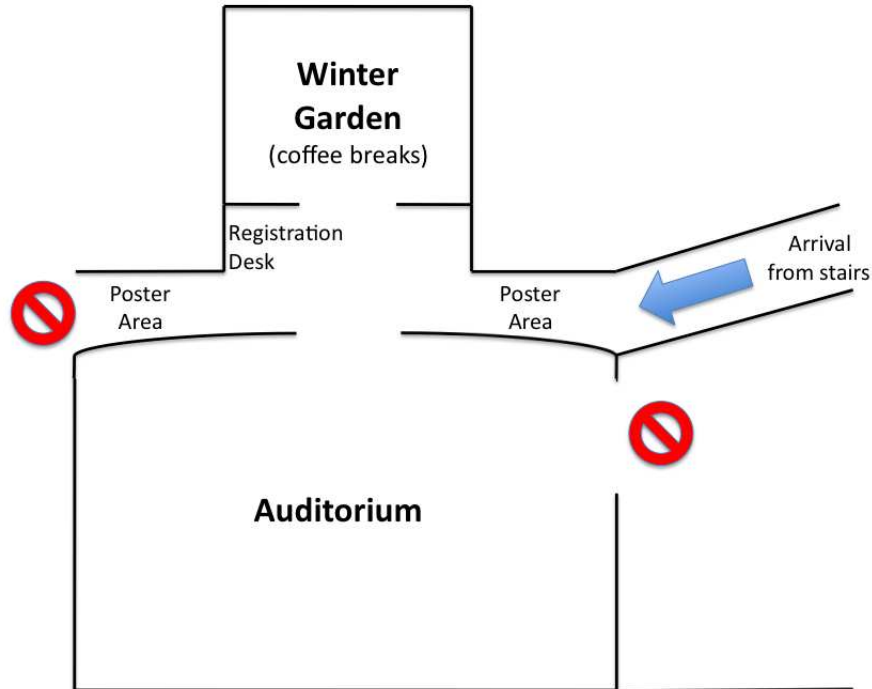
There will always be one of them at the registration desk, open each day from 9:00 to 18.00. We suggest to ask them.

In case of *extreme emergency*, you can directly dial the following numbers, which are free from any Italian phone:

- **112** Carabinieri
- **113** Police
- **115** Fire brigade
- **118** Hospital

PRESENTATIONS:

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**Acquarium – Detail map of the 1st Floor**

**Not in scale**

**Talks:**

There will be two computers available for all the presentations (Mac and Windows). The speakers have to contact the LOC *at least* before the beginning of the session where they will present their talk, so to upload the file(s) in the computer and perform some check. Formats allowed are the usual PPT, PDF and KEYNOTE. The speakers of the first session, in the morning of Monday 4 April, are encouraged to send their presentation by email to the LOC (please contact the LOC in case of very large files).

The files will be uploaded on the web site of the workshop for the free download. If one speaker does not want to make his/her presentation publicly available, then he/she has to explicitly specify this caveat to the LOC before or at the moment of the upload in the conference computers.

**Posters:**

Posters (format A0, 841 × 1189 mm) can be attached to the walls of the auditorium by using a proper gum, in order to avoid damaging the walls. Please ask at the registration desk. Posters can be attached at the arrival and detached at the end of the workshop. The poster viewing will be during the coffee breaks.

**Proceedings:**

The proceedings of the workshop will be published online by *Proceedings of Science*. A web page dedicated to the workshop has been set up at:

<http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=126>

Instructions and LaTeX or MS Word templates for manuscripts are available at the web page of the workshop (see the link “Proceedings” in the menu on the left). There is no limit on the number of pages for both talks and posters.

**Deadline to submit the manuscript for the proceedings is 30 April 2011**

# **Workshop Program**

Last Updated: April 1, 2011



## 4 April 2011 – General Properties, Surveys

09:00–09:10 – Welcome, G. PARESCHI (Director OA Brera)

Morning Session – Chair: S. Mathur

09:10–09:55 – R. POGGE: “A Quarter Century of Narrow-Line Seyfert 1s” (*invited*)

09:55–10:40 – T. BOROSON: “NLS1 Properties and Demographics” (*invited*)

10:40–11:10 – *Coffee break - Poster viewing*

11:10–11:30 – D. GRUPE: “Statistical analysis of an AGN sample with simultaneous UV and X-ray observations with *Swift*”

11:30–11:50 – J. STERN: “The continuum and emission line properties of NLS1s based on a new SDSS sample of low luminosity type-1 AGN”

11:50–12:10 – D. XU: “The NLR in narrow-line Seyfert 1 galaxies”

12:10–14:00 – *Lunch break*

Afternoon Session – Chair: T. Boroson

14:00–14:20 – G. J. FERLAND: “Molecular hydrogen in NLSys and its implications for the SED”

14:20–14:40 – R. SAXTON: “The long-term variability of a large sample of AGN”

14:40–15:00 – H. LANDT: “The near-IR broad-emission line region of AGN”

15:00–15:20 – E. SANI: “Enhanced star formation in Narrow-Line Seyfert 1 galaxies”

15:20–15:40 – R. MOR: “Hot dust, warm dust and star formation in NLS1s”

15:40–16:10 – *Coffee break - Poster viewing*

16:10–16:30 – M. KRAUSE: “Dynamics of clouds in the broad-line region”

16:30–16:50 – G. LA MURA: “Emission line profiles and X-ray observations of Broad and Narrow Line Seyfert 1 galaxies”

16:50–17:10 – A. TARCHI: “Water masers in NLS1 galaxies”

## 5 April 2011 – High Energy Emission, Jets and Outflows

Morning Session – Chair: D. Grupe

09:00–09:45 – A. C. FABIAN: “An X-ray view of NLS1” (*invited*)

09:45–10:05 – L. GALLO: “The X-ray weak state of Narrow-Line Seyfert 1 galaxies”

10:05–10:25 – T. J. TURNER: “X-ray signatures of circumnuclear gas in AGN”

10:25–10:55 – *Coffee break - Poster viewing*

10:55–11:15 – L. MILLER: “X-ray reverberation in NLS1”

11:15–11:35 – A. ZOGHBI: “X-ray reverberation delays in NLS1”

11:35–11:55 – C. RICCI: “The average hard X-ray spectra of NLS1”

11:55–12:15 – F. PANESSA: “The *INTEGRAL* Narrow-Line Seyfert 1 Galaxies”

12:15–14:15 – *Lunch break*

Afternoon Session – Chair: L. Gallo

14:15–14:35 – L. FOSCHINI: “Evidence of powerful relativistic jets in narrow-line Seyfert 1 galaxies”

14:35–14:55 – M. GIROLETTI: “Global eVLBI observations of J0948+0022”

14:55–15:15 – M. GLIOZZI: “Long-term multiwavelength properties of PKS 0558-504, a highly accreting BH with a radio jet”

15:15–15:35 – L. FUHRMANN: “Gamma-ray NLSy1s and ‘classical’ blazars: are they different at radio cm/mm bands?”

15:35–16:00 – *Coffee break - Poster viewing*

16:00–16:20 – M. CRENSHAW: “Mass outflows in Narrow-Line Seyfert 1 Galaxies”

16:20–16:40 – G. RISALITI: “Outflowing clouds in the NLS1 Mrk 766”

16:40–17:00 – A. LOBBAN: “Contemporaneous *Chandra* HETG and *Suzaku* X-ray observations of NGC 4051”

17:00–17:20 – J. EBRERO: “Disentangling the complex absorption spectrum of NGC 7314”

20:00 – *Social Dinner at the Restaurant “Fiori Oscuri”*

## 6 April 2011 – Masses, Host Galaxies, Evolution

Morning Session – Chair: R. Pogge

09:00–09:45 – B. PETERSON: “Masses of Black Holes in Active Galactic Nuclei: Implications for Narrow-Line Seyfert 1 Galaxies” (*invited*)

09:45–10:05 – M.C. BENTZ: “Black hole scaling relationships and NLS1s”

10:05–10:25 – K.C. DENNEY: “Addressing systematic uncertainties in black hole mass measurements”

10:25–10:55 – *Coffee break - Poster viewing*

10:55–11:15 – S. MATHUR: “Host galaxies of NLS1s”

11:15–11:35 – G. ORBAN DE XIVRY: “Past and present secular evolution in the host galaxies of NLS1s”

11:35–11:55 – R. DAVIES: “Cosmic Evolution of NLS1 and the Growth of their Black Holes”

11:55–14:00 – *Lunch break*

Afternoon Session – Chair: B. Peterson

14:00–14:20 – M. VESTERGAARD: “Black hole mass estimations - limitations and current efforts for improvements”

14:20–14:40 – J.-H. WOO: “The overall uncertainty of single-epoch virial black hole mass estimators and its implication to the  $M - \sigma$  relation”

14:40–15:00 – A. MARCONI: “The effect of radiation pressure on virial black hole mass estimates: the case of narrow line Seyfert 1 galaxies”

15:00–15:20 – R. DECARLI: “BH masses in NLS1: the role of the broad-line region geometry”

15:20–15:40 – A. WANDEL: “On the low BH/bulge ratio of NLS1”

15:40–16:00 – A. CHECKTMAN: “Mass determination of the supermassive black hole of NGC 4051 Seyfert 1 galaxy based on X-ray spectrum fitting with generic Comptonization model”

16:00 – Final Remarks, L. Foschini

16:01 – *Goodbye Coffee*

## Invited Talks

T. BOROSON

*National Optical Astronomy Observatory, Tucson, AZ 85719 (USA)*

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## **NLS1 Properties and Demographics**

NLS1s lie at an extreme of the distribution of characteristics of AGN. Thus, they are important for understanding how these characteristics translate into physical parameters. Are NLS1s the limiting case of the AGN phenomenon or an early stage that all AGN pass through? Or are their extreme properties the result of a particular orientation? This talk summarizes the distinguishing properties of NLS1s, and explores how they fit into our picture of AGN. Recent large surveys allow us to learn about their demographics, both generally (what fraction of quasars have NLS1 properties?), and in terms of specific characteristics (how does the orientation distribution of NLS1s differ from that of other objects?). PCA is useful in extracting information from these large datasets. A combination of approaches allows us to address specific questions about NLS1s: (1) their location in the  $M - \sigma$  plane, (2) their role in AGN evolution, including evidence for star formation and outflows.

A. C. FABIAN

*Institute of Astronomy, Cambridge, CB3 0HA (UK)*

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## **An X-ray view of NLS1**

NLS1 have proved to be interesting objects for X-ray observation. *ROSAT* was particularly sensitive to them due to their soft spectra. They have since been good targets for *XMM*, often showing complex spectra and rapid variability. General properties will be reviewed and some favourites, such as 1H 0707–495, will be discussed in detail.

B. PETERSON

*Department of Astronomy, The Ohio State University, Columbus, OH 43210 (USA)*

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## **Masses of Black Holes in Active Galactic Nuclei: Implications for Narrow-Line Seyfert 1 Galaxies**

The masses of the supermassive black holes in the nuclei of nearby quiescent and active galaxies can be measured by modeling of stellar or gas dynamics on resolvable scales, although this is particularly difficult when there is an active nucleus present. In the case of active galaxies, the central mass can also be measured by the process of reverberation mapping: the time-delayed response of the broad emission lines to continuum flux variations allows us to determine the size of the line-emitting region, and the mass of the central object is obtained by combining the size with the Doppler-broadened line width. Reverberation mapping also establishes simple scaling relationships that can be used to estimate the masses of black holes in large samples of quasars based on single spectra. In this talk, I will review both progress and challenges in measurement of black hole masses, with particular attention to implications for our understanding of the narrow-line Seyfert 1 phenomenon.

R. POGGE

*Department of Astronomy, The Ohio State University, Columbus, OH 43210 (USA)*

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## **A Quarter Century of Narrow-Line Seyfert 1s**

The Narrow-Line Seyfert 1 class was given its name and basic spectroscopic classification criteria in a 1985 paper by Don Osterbrock and myself that came out of a project begun during my first-year as a graduate student at UC Santa Cruz. This talk will look at NLS1s over the past quarter century, the art of AGN observation and classification, and the many contributions of Don Osterbrock to our field.



## Contributed Talks

M. C. BENTZ

*Department of Physics and Astronomy, Georgia State University, Atlanta, GA 30303, (USA)*

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## **Black Hole Scaling Relationships and NLS1s**

The vast majority of black hole masses that populate the literature are deduced from scaling relationships. Of these, the relationship between the radius of the broad line region and the luminosity of the AGN (the  $R-L$  relationship) is perhaps the most widely used and is based on reverberation mapping experiments of low-redshift AGNs. Recent campaigns at MDM Observatory and Lick Observatory have revised and added several new reverberation measurements, several of which are based on observations of NLS1s. I will discuss ongoing work to recalibrate the  $R-L$  relationship with the new reverberation results and *HST* imaging. I will also briefly describe ongoing work to recalibrate the scaling relationship between the black hole mass and host galaxy bulge luminosity for AGNs and how this compares to the same relationship for quiescent galaxies. Finally, I will describe the NLS1s relative to the rest of the reverberation sample in the context of these scaling relationships.

A. CHEKHTMAN

*Space Science Division, Naval Research Laboratory, Washington, DC 20375 (USA)*

and L. Titarchuk

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## **Mass determination of the supermassive black hole of NGC 4051 Seyfert-1 galaxy based on X-ray spectrum fitting with generic Comptonization model**

We present the analysis of soft X-ray emission of NGC 4051 Seyfert-1 galaxy measured by EPIC instrument of *XMM-Newton* X-ray telescope. We used Comptonization model (COMPTB) to fit various spectra obtained for the time period from 2001 to 2009. The analysis showed that these spectra demonstrate the transitions between low/hard and high/soft states. The time scale of these transitions is of order of few days which points to relatively low black hole (BH) mass. The similar spectral transitions were observed in galactic BH sources. In particular, we discovered that photon index correlates with disc mass accretion rate represented by normalization of soft black body component. This correlation is similar to the one found for the Galactic black hole X-ray binary GRO J1655. Comparison of these two correlations allows us to estimate the BH mass in NGC 4051 taking BH mass in GRO J1655 as a reference. We do obtain that the value of BH mass is approximately  $2 \times 10^5$  solar masses.

D. M. CRENSHAW

*Department of Physics and Astronomy, Georgia State University, Atlanta, GA 30303, (USA)*

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## **Mass Outflows in Narrow-Line Seyfert 1 Galaxies**

We compare the characteristics of mass outflows of ionized gas in NLS1s with those in their broad-line counterparts. Are there differences that yield clues to the geometry of the outflows or the driving mechanisms? We address these questions using HST high signal-to-noise, high resolution spectra of the UV absorbers at distances of 0.1 to 10 parsecs from the central nucleus and long-slit spectra of the emission-line outflows on larger scales in their narrow-line regions.

R. DAVIES

*Max-Planck-Institut für Extraterrestrische Physik, 85740 Garching (Germany)*

and G. Orban de Xivry, M. Schartmann, S. Komossa, A. Marconi, E. Hicks, H. Engel,  
L. Tacconi, R. Genzel

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## **Cosmic Evolution of NLS1s and the Growth of their Black Holes**

In a companion contribution we show that the evolution of NLS1s has been dominated at all cosmic times by secular evolution rather than mergers. Here we build on that result to understand what it implies about their black hole growth. By estimating the duty cycle of the AGN in NLS1s, and considering how long they can have been accreting rapidly, we show that NLS1s are not in a special phase of black hole growth. Several more Gyr are required for their BH masses to become similar to BLS1s. Since NLS1 host galaxies have pseudo-bulges, we might expect them to lie under the  $M - \sigma$  relation as other galaxies with pseudo-bulges do. We discuss what physical mechanism might be responsible for this, concluding that it is the angular momentum of the inflowing gas that hinders accretion and is the root cause of the lower mass of black holes in NLS1s.

R. DECARLI

*Max-Planck-Institut für Astronomie, 69117 Heidelberg (Germany)*

and M. Dotti, A. Treves, F. Haardt

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## **BH masses in NLS1: The role of the Broad Line Region geometry**

Narrow Line Seyfert 1 galaxies (NLS1) are generally believed to host “under-massive” black holes with respect to the predictions from the host galaxy – black hole mass scale relations. Black hole masses in NLS1 are estimated from the continuum luminosity and the width of broad emission lines. Here we show that the “mass deficit” can be canceled out if we assume that the broad line region (BLR) in type-1 AGN has a flat geometry, which is seen face-on in NLS1. The detection of relativistic jets aligned along the line of sight in a number of NLS1 supports this picture. Moreover, a flat geometry of the BLR is also suggested by a general trend of the mass deficit as a function of the line width observed in other type-1 AGN, from quasars to BL Lac objects, and is consistent with a simple extension of the Unified Model of AGN to the BLR geometry.

K. D. DENNEY

*Dark Cosmology Centre, Niels Bohr Institute, University of Copenhagen, 2100 Copenhagen (Denmark)*

and R. J. Assef, K. Horne, C. S. Kochanek, B. M. Peterson, R. W. Pogge, M. Vestergaard

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## **Addressing Systematic Uncertainties in Black Hole Mass Measurements**

We present selected efforts underway to mitigate systematic uncertainties in supermassive black hole (BH) mass estimates. First, we show that single-epoch CIV-based BH mass estimates are consistent with their Balmer-based counterparts when efforts are made to use only high S/N data and a homogeneous prescription for line width and luminosity measurements and to correct an observed color dependence in the CIV-to-Balmer mass ratio residuals. Second, we present recent, detailed reverberation mapping results by showcasing a velocity-delay map of the NLS1 galaxy NGC 4051. This visualization of the transfer function describing the emission line response of the broad line region (BLR) gas to variations in the continuum emission shows the kinematics and geometry of the BLR in velocity and time-domain space. These maps will help to constrain the geometrical scale factor,  $\langle f \rangle$ , that is currently the largest source of systematic uncertainty in direct, reverberation-based BH mass measurements.

J. EBRERO

*SRON Netherlands Institute for Space Research, 3584 CA, Utrecht (The Netherlands)*

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## **Disentangling the complex absorption spectrum of NGC 7314**

The differences between Type-1 and Type-2 AGN are believed to arise only due to the presence of absorbing material along our line of sight. A Compton-thick molecular torus, located at pc-scale distances, is claimed to be responsible for this dichotomy. However, as there is increasing evidence that such a simple scenario may not hold for all objects, a global picture of the different absorbing material along our line of sight is required to test the current Unification Models of AGN.

We present here the results of a multi-instrument X-ray analysis of the Narrow Line Seyfert 1 galaxy NGC 7314. There is evidence of both neutral and ionized absorbers in its soft X-ray spectrum, which have been simultaneously detected only in a handful of sources so far. The *XMM-Newton* RGS spectral analysis of both kinds of absorbers suggests that our line of sight grazes the edge of the putative torus, thus providing a unique look into the inner environment of the AGN.



G. J. FERLAND

*Physics, University of Kentucky, Lexington, KY 40506 (USA)*

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## **Molecular hydrogen in NLSys, and its implications for the SED**

The family of AGN present a sequence of increasing H2 / H I and FeII / H I emission line intensity ratios. The largest values are found in the lower luminosity Narrow Lined Seyfert 1 Galaxies. I show that this is best understood as a correlation between the shape of SED at ionizing energies and luminosity. This has implications for the nature of the accretion disk and its dependence on accretion rate and black hole mass.

L. FOSCHINI

*INAF – Osservatorio Astronomico di Brera, 23807, Merate (LC), (Italy)*

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## **Evidence of powerful relativistic jets in Narrow-Line Seyfert 1 Galaxies**

In 2008, the *Fermi Gamma-ray Space Telescope* has revealed - for the first time - high-energy ( $E > 100$  MeV) gamma rays from a few Narrow-Line Seyfert 1 Galaxies (NLS1). Later, in 2009 and 2010, two multifrequency campaigns on one of these sources, PMN J0948+0022 ( $z = 0.585$ ), definitely confirmed the presence, in sources of this type, of a relativistic jet very similar and with comparable power to those in blazars. However, these sources are neither blazars nor radio galaxies, as proved by their optical spectrum and by their very compact radio morphology. Moreover, since NLS1 are generally hosted in spiral galaxies, this casts a significant doubt on the paradigm of the correlation between jets and elliptical host galaxies. This poses intriguing challenges to the current knowledge of jet systems and on how these structures are generated. The current status of the researches in this field is reviewed and ongoing work is outlined.

L. FUHRMANN

*Max-Planck-Institut für Radioastronomie, 53121 Bonn (Germany)*

and E. Angelakis, I. Nestoras, T. P. Krichbaum, J. A. Zensus, L. Foschini

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## **Gamma-ray NLSy1s and “classical” blazars: Are they different at radio cm/mm bands?**

Since the early *Fermi*-*GST* discovery of NLSy1s as a new class of gamma-ray emitting AGN, we are monitoring the first source of this new class, J0948+0022, within a *Fermi*-dedicated blazar monitoring alliance called the *F-GAMMA* program: a sample of about 65 gamma-ray loud blazars is observed monthly with the Effelsberg 100-m and IRAM 30-m telescopes quasi-simultaneously at 10 frequencies between 2.6 and 142 GHz (11 cm to 2 mm wavelength). In 2010, we extended the program towards two further *Fermi*-detected NLSy1s, namely 1H 0323+342 and PKS 1502+036. Here we present the first results of this cm/mm band monitoring of gamma-ray NLSy1s with particular emphasis on their spectral and variability properties. Subsequently, we compare these properties with those obtained for the “classical” *Fermi*-detected blazars in our sample and explore possible, systematic differences in their radio characteristics and corresponding physical parameters.

L. GALLO

*Department of Astronomy and Physics, Saint Mary's University, Halifax, NS B3H 3C3, (Canada)*

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## **The X-ray weak state of Narrow-line Seyfert 1 galaxies**

AGNs in an X-ray weak state, when the direct power law component is significantly diminished, provide the opportunity to study the nature of the other continuum components. NLS1s are regularly caught in an X-ray weak state and consequently are excellent laboratories to study these features. We will discuss our efforts to catch NLS1s in a weak state and the results of our analyses.

M. GIROLETTI

*INAF – Istituto di Radioastronomia, Bologna (Italy)*

and Z. Paragi, H. Bignall, A. Doi, L. Foschini, K. Gabanyi, C. Reynolds

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## **Global eVLBI observations of J0948+0022**

We have performed three real-time e-VLBI observations of PMN J0948+0022 at 22 GHz, using a global array including telescopes in Europe, East Asia, and Australia, reaching a maximum baseline length of 12458 km. The observations were part of a large multi-wavelength campaign in 2009. We report on the results, including flux density, brightness temperature, jet structure, polarization. Overall, these provide strong support for the presence of a relativistic jet in this source. We also present a new VLBI project aimed at improving our understanding of this jet, by studying proper motion and Faraday rotation.

M. GLIOZZI

*George Mason University, Fairfax, VA 22030 (USA)*

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## **Long-term multi-wavelength properties of PKS 0558–504, a highly accreting BH with a radio jet**

The radio-loud Narrow-Line Seyfert 1 galaxy PKS 0558–504 is a highly variable, X-ray bright source with super-Eddington accretion rate and a powerful radio jet that does not dominate the emission beyond the radio band. Hence this source represents an ideal laboratory to shed some light on the central engine of NLS1 and specifically on the link between accretion disk, corona and ejection phenomena. Here we present the preliminary results from a 1.5-year multiwavelength campaign with *Swift* XRT and UVOT, complemented with radio observations. We combine complementary pieces of information from different energy bands to investigate the energetics of accretion and ejection phenomena in this extreme black hole system.

D. GRUPE

*Department of Astronomy and Astrophysics, Pennsylvania State University, University Park, PA 16802 (USA)*

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## **Statistical Analysis of an AGN sample with simultaneous UV and X-ray observations with *Swift***

I will report on the statistical analysis of a sample of about 100 AGN with simultaneous UV and X-ray observations with *Swift*. I found clear correlations between the X-ray spectral slope  $\alpha_X$ , the UV slope  $\alpha_{UV}$ , and the optical-to-x-ray spectral slope  $\alpha_{OX}$  with the Eddington ratio  $L/L_{Edd}$ . I will also report on the bolometric corrections for  $L_{0.2-2.0\text{keV}}$  and  $L_{5100\text{\AA}}$ . A major aspect of the statistical analysis will be multi-variant analysis statistical tools such as the Principal Component Analysis (PCA) and cluster analysis. This analysis shows that the main driver of the AGN properties in this sample is the Eddington ratio  $L/L_{Edd}$ . Although separating Seyfert 1s into NLS1s and BLS1s is a good classification, with the 2000 km/s cutoff line it is still arbitrary. A better classification scheme may be to separate AGN into low and high  $L/L_{Edd}$  AGN.

M. KRAUSE

*Universitätssternwarte München, 81679 München, Germany*

and M. Schartmann, A. Burkert

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## **Dynamics of Clouds in the Broad Line Region**

Clouds in the vicinity of strongly radiating Active Galactic Nuclei suffer from various instabilities: orbital (they might be blown away as a whole by the radiation pressure), hydrodynamical, and radiative shearing. Magnetic fields have been proposed as a stabilisation mechanism. We have performed orbital and magnetohydrodynamic simulations to address this problem. I will present our recent results and discuss in particular the apparently low velocities in NLS1s.



G. LA MURA

*Department of Astronomy, University of Padova, I-35122 Padova (Italy)*

and S. Ciroi, D. Ilic, L. C. Popovic, P. Rafanelli

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## **Emission line profiles and X-ray observations of Broad and Narrow Line Seyfert 1 galaxies**

NLS1 line profiles, combined with the luminosity estimates comparable to the broad line sources, suggest that some extreme property is characterizing their fueling. Two hypotheses are usually considered: a nearly pole-on view on a flattened structure, or a relatively low mass black hole, accreting at very high rates. Both explanations provide advantages and drawbacks, but, in spite of the different assumed physics, they agree in identifying NLS1 as the crucial test ground for our understanding of the BLR structure and dynamics in AGN. In this contribution we report the study of asynchronous optical and X-ray spectra of a sample of broad and narrow line emitting Seyfert 1 galaxies. Exploiting data collected by the *XMM* instruments, we identify the broad band X-ray spectral components of the two classes. We discuss the relation that thermal, non-thermal, line emission and broad band absorptions show with the optical emission line profiles, as interpreted with a composite BLR model.

H. LANDT

*School of Physics, University of Melbourne, Parkville, VIC 3010 (Australia)*

and M. J. Ward, M. Elvis, K. Korista, B. M. Peterson, M. C. Bentz, M. Karovska

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## **The near-IR broad-emission line region of AGN**

I will discuss the main results from our on-going near-IR and quasi-simultaneous optical spectroscopic programme of broad-line AGN. Our near-IR spectra have a large wavelength coverage ( $0.8 - 2.4 \mu\text{m}$ ), medium resolution and relatively high S/N ratio ( $> 100$ ). The focus will be on the kinematics of the hydrogen emitting region and the properties of the hottest dust component. Furthermore, I will introduce the near-IR radius-luminosity relationship, which is expected to be used to derive black hole masses in particular of obscured AGN. NLSy1s represent roughly a third of our sample and their properties will be compared to those of the total sample.

A. P. LOBBAN

*Astrophysics Group, School of Physical and Geographical Sciences, Keele University, Keele, ST5 8EH (UK)*

and J. N. Reeves, L. Miller, T. J. Turner, V. Braito, S. B. Kraemer, D. M. Crenshaw

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## **Contemporaneous *Chandra* HETG and *Suzaku* X-ray Observations of NGC 4051**

I will present the results of a deep, contemporaneous *Chandra* HETG (300 ks) and broadband *Suzaku* (350 ks) X-ray observation of the highly variable narrow-line Seyfert 1 galaxy NGC 4051. The spectra reveal a complex warm absorber including significant absorption from blueshifted H-like and He-like Fe suggestive of a highly ionised, high velocity outflow ( $v \sim 0.02c$ ) which may potentially have a significant effect on the host galaxy via feedback. I will also present the results of our simultaneous analysis of the 2008 *Suzaku* data with archival *Suzaku* data from 2005 when the source was observed to have entered an extended period of low flux as a way to study the long-term spectral variability. I will show that this can be accounted for by allowing for large variations in the normalisation of the intrinsic power-law component which may be interpreted as being due to significant changes in the covering fraction of a Compton-thick partial-coverer obscuring the central continuum emission.

A. MARCONI

*Dipartimento di Fisica e Astronomia, Università degli Studi di Firenze, 50125 Firenze (Italy)*

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## **The effect of radiation pressure on virial black hole mass estimates: the case of narrow line Seyfert 1 galaxies**

One of the open questions in the study of Narrow Line Seyfert 1 galaxies is whether the relatively small broad line widths reflect intrinsically small black hole masses and how these relate to the structural parameters of the host bulges. In this talk I will consider the effect of radiation pressure on virial black hole mass estimates. I will discuss the inconclusiveness of tests which has been proposed so far, and I will present new evidence on the importance of radiation pressure on the motions of BLR clouds. I will then explore the consequences of “corrected” virial mass estimates on BH-galaxy scaling relations involving NLS1 galaxies.

S. MATHUR

*Department of Astronomy, The Ohio State University, Columbus, OH 43210 (USA)*

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## Host galaxies of NLS1s

We present HST/ACS observations of ten NLS1 galaxies. Previous results suggest that NLS1s contain relatively smaller mass black holes accreting at high Eddington ratio. They also appear to occupy distinct loci on black hole mass–bulge properties scaling relations. With ACS observations we obtained photometric characteristics of these galaxies to find out if they are indeed different. We find that all ten galaxies lie below the Kormendy relation, so can be classified as having pseudobulges even though only four have Sersic indices less than 2. All ten galaxies lie below the  $M_{BH}-L_{bulge}$  relation, confirming earlier results. Their locus is similar to that occupied by pseudobulges. We conclude that the black holes in narrow line Seyfert 1s are still growing and are likely fueled by secular processes, rather than mergers. Active galaxies in pseudobulges point to an alternative track of black hole–galaxy co-evolution.

L. MILLER

*Department of Physics, Oxford University, Oxford OX1 3RH (UK)*

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## **X-ray reverberation in NLS1**

Narrow-line Seyfert 1s are highly variable at X-ray energies and commonly show time lags between the hard and soft X-ray wavebands, with delays in the range 10s to 1000s secs. We have recently shown how these time delays, their dependence on photon energy and their dependence on variability frequency may all be understood as signatures of reverberation in the X-ray waveband. We show how changes in sign of the time lags with frequency arise naturally in reverberation models. The reverberation signatures are consistent with spectral analyses that indicate high covering factors of absorbing and scattering material, and we discuss the significance of these results for models of AGN in general, and NLS1 in particular.

R. MOR

*School of Physics and Astronomy and the Wise Observatory, The Raymond and Beverly Sackler Faculty of Exact Sciences,  
Tel-Aviv University, Tel-Aviv 69978 (Israel)*

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## Hot Dust, Warm Dust and Star Formation in NLS1s

We present the results of an IR spectral decomposition of an extensive sample of NLS1s, BLS1s, and high luminosity type-I QSOs. The range in bolometric luminosity is  $10^{(43.3-46.7)}$  erg/s. We fit *Spitzer*/IRS spectra and NIR photometry by a three component model: a dusty torus, a dusty NLR, and a very hot, graphite-only, dust located at the innermost edge of the torus. To estimate the star formation in the host galaxies, we use measurements of the strong PAH features and  $60\ \mu\text{m}$  *IRAS* photometry. We find that the NIR emission, peaking at  $\sim 3\ \mu\text{m}$ , is dominated by the hot dust whose distance to the center correlates with the AGN luminosity. This component affects both the energy reaching torus and its derived SED. The distance to the NLR also correlates with source luminosity, and its covering factor is consistent with previous results. A major result is that the covering factor of the dusty clouds tend to be smaller in NLS1s compared with BLS1s.

G. ORBAN DE XIVRY

*Max-Planck-Institut für Extraterrestrische Physik, 85740 Garching (Germany)*

and R. Davies, M. Schartmann, A. Marconi, S. Komossa, E. Hicks, H. Engel, L. Tacconi, R. Genzel

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## **Past and Present Secular Evolution in the Host Galaxies of NLS1s**

In this contribution we show that the host galaxies of NLS1s differ dramatically from those of BLS1s. This leads us to propose that NLS1s represent a class of AGN in which the black hole growth is, and has always been, dominated by secular evolution. Our line of argument is as follows. First, we show that the evolution of NLS1s is currently mainly driven by secular processes, much more so than for BLS1s. Secondly, a statistical study of the bulges of NLS1s and BLS1s galaxies indicates that NLS1 host bulges are pseudo-bulges and distinct from BLS1 bulges. This difference points to the particular importance of secular processes in the past evolution of their hosts. We verify that the fraction of galaxies similar to NLS1s is consistent with the population of galaxies whose evolution is expected to have been purely secular, with no major mergers. We finish by speculating about the implications for their black hole spin, which will be measured in a systematic way by future X-ray missions.



F. PANESEA

*INAF – IASF-Roma, Roma (Italy)*

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## **The *INTEGRAL* Narrow Line Seyfert 1 galaxies**

Narrow Line Seyfert 1 galaxies are among the most interesting class of active nuclei. Their observational properties suggest that they are high accretion rate systems probably associated with relatively small black hole masses with compared to classical Seyfert 1 galaxies. However, the number of known NLSy1 detected above 10 keV is small notwithstanding the importance of the high energy data to discriminate between the major compelling models. Here we present a detailed study of a sample of 14 NLSy1 detected above 10 keV by *INTEGRAL*/IBIS, through an accurate broad-band analysis using *INTEGRAL* data combined with *XMM-Newton*, *Suzaku* and *Swift*. Their high energy spectral properties have been related to their accretion parameters in order to unveil the nature of these extreme AGN. We have estimated the fraction of NLSy1 in the hard X-ray sky to be nearly 15%, in agreement with the estimate derived from optically selected NLSy1 samples.

C. RICCI

*ISDC Data Centre for Astrophysics, Observatoire de Genève, Université de Genève, 1290 Versoix (Switzerland)*

and R. Walter, T. Courvoisier, S. Paltani

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## **The average hard X-ray spectra of NLS1**

I will present the results obtained from the deepest (with exposures up to  $\sim 50$  Ms) study ever performed of the average hard X-ray spectra of Seyfert galaxies. Our sample includes all the  $\sim 200$  Seyfert galaxies detected by *INTEGRAL*, of these 68 are Seyfert 1, 38 Seyfert 1.5, 77 Compton thin Seyfert 2, 12 NLS1, and 13 Compton thick (CT) Seyfert 2. For each class, we produced the average spectrum in the 17 – 250 keV energy range. From both a model-dependent and a model-independent analysis, we found that the characteristics of the average hard X-ray spectrum of NLS1 are consistent with those of Seyfert 1 and Seyfert 1.5, while the average spectrum of Compton thin Seyfert 2 shows a significantly stronger reflection component than all the other classes. I will discuss our results in the light of the unified model of AGN, and of the commonly accepted idea that NLS1 have a softer spectrum than Seyfert 1 and Seyfert 1.5.

G. RISALITI

*INAF – Osservatorio Astronomico di Arcetri, Firenze (Italy)*

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## **Outflowing clouds in the NLS1 Mrk 766**

I report the results of a time-resolved spectral analysis of an *XMM-Newton* long observation of Mrk 766, showing that the X-ray source has been eclipsed several times by clouds with a cold, dense core, and a less dense, highly ionized tail. These clouds have blueshift velocities of several thousand km/s (as measured through He-like iron absorption lines), and are therefore part of a strong outflow. These results provide new important constraints on the geometry and structure of this source, and may be relevant to understand the peculiarity of NLS1s as a class of AGNs.

E. SANI

*INAF – Osservatorio Astronomico di Arcetri, Firenze (Italy)*

and D. Lutz, L. Gallo, H. Netzer, B. Trakhtenbrot, E. Sturm, G. Risaliti, T. Boller

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## **Enhanced star formation in Narrow-Line Seyfert 1 galaxies**

We present new *Spitzer* mid-IR spectroscopy of local NLS1s. We detect strong AGN continuum in all and clear PAH emission in 70% of the sources. The PAH luminosity spans three orders of magnitude, from  $\sim 10^{39}$  to  $\sim 10^{42}$  erg/s, providing strong evidence for intense ongoing star formation in the circumnuclear regions of NLS1s. We constructed NLS1 and BLS1 subsamples to compare them in various ways. The comparison shows a clear separation according to FWHM such that objects with narrower broad  $H\beta$  lines are the strongest PAH emitters. We test this division in various ways trying to remove biases due to luminosity and aperture size. We find that star formation activity around NLS1 AGN is larger than around BLS1 of the same AGN luminosity. The above result seems to hold over the entire range of distance and luminosity. Moreover, the star formation rate is higher in low black hole mass and high  $L/L_{Edd}$  systems indicating that black hole growth and star formation are occurring simultaneously.

R. SAXTON

*XMM SOC, European Space Astronomy Centre (ESAC), 28691 Madrid (Spain)*

and G. Miniutti, A. Read, P. Esquej

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## **The long-term variability of a large sample of AGN**

We report on a study of long-term flux variations in a sample of more than 1000 AGN observed with *ROSAT* and in the *XMM-Newton* slew survey. Over a period of 5–15 years, NLS1 as a class are found to be only slightly more variable than broad line Seyfert galaxies, despite the strong short term variability seen in some bright nearby NLS1. Contrary to expectations, it is Seyfert II galaxies that exhibit the greatest flux volatility. Although it is plausible that changes in the obscuring column are behind this effect, there is evidence that it is the “true Seyfert II” galaxies, those which fail to form a BLR due to insufficient luminosity or accretion rate, that exhibit the greatest fluctuations. One particular SY II, which has brightened by a factor  $> 200$  over 15 years, has been monitored in detail with *Swift* and *XMM*. The spectrum is extremely soft ( $kT \sim 50$  eV) consistent with pure thermal emission from an accretion disk and reminiscent of the NLS1, WPVS 007.

J. STERN

*Technion, 32000, Haifa (Israel)*

and A. Laor

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## **The continuum and emission line properties of NLS1's based on a new SDSS sample of low luminosity type-1 AGN**

We explore the spectral energy distributions (SED) and emission line properties of low luminosity type-1 AGN, as a function of the broad H $\alpha$  luminosity ( $L_{bH\alpha}$ ), optical slope ( $\alpha_\nu$ ), and broad H $\alpha$  width ( $\Delta v$ ). The analysis is performed on a new sample of type-1 AGN, selected from the SDSS galaxy and quasar catalogues according to the presence of broad H $\alpha$  emission. We measure the luminosity and profile of the broad H $\alpha$  feature, along with the narrow line luminosities, by carefully decomposing the broad profile from adjacent narrow lines. The result of this process is 3824 objects with  $7 \times 10^{39} \text{ erg s}^{-1} < L_{bH\alpha} < 10^{44} \text{ erg s}^{-1}$  and  $1000 \text{ km s}^{-1} < \Delta v < 25000 \text{ km s}^{-1}$ , supplemented by UV, NIR and X-ray data from the *GALEX*, 2MASS and *ROSAT* surveys. We present the mean SED of AGN in  $L_{bH\alpha}$ -bins. These mean SED are consistent with the mean SED of luminous quasars scaled by  $L_{bH\alpha}$ , plus the mean SED of inactive SDSS galaxies with the same redshift distribution. To explore the range of SED at a given  $L_{bH\alpha}$ , we further divide each luminosity bin to sub-bins based either on  $\alpha_\nu$  or on  $\Delta v$ . These sub-bins demonstrate the possible effect of  $L/L_{Edd}$ ,  $M_{BH}$ , and reddening on the distribution of SED forms and spectral features. Also, we find significant trends in: 1. the broad H $\alpha$  profile and peak, with  $\Delta v$ ; 2. the narrow line to broad line luminosity ratio with  $L_{bH\alpha}$ ; 3. the narrow line ratios (position in the BPT diagrams) with AGN attributes. The above results will be used to highlight the special characteristics of NLS1s.

A. TARCHI

*INAF – Osservatorio Astronomico di Cagliari, 09012 Capoterra (CA) (Italy)*

and P. Castangia, A. Columbano, F. Panessa, J. A. Braatz

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## **Water masers in NLS1 galaxies**

Luminous extragalactic water masers originate in warm and dense gas in the innermost regions of AGN tracing circumnuclear accretion disks, relativistic jets, or nuclear outflows. So far, the majority of water maser sources have been detected in Sy2 galaxies. Among the few exceptions are the water masers hosted by Narrow-Line Seyfert 1 (NLS1) galaxies. We have studied available line and continuum data at radio frequencies of the four NLS1 galaxies (NGC 4051, NGC 4253, NGC 5506, and IGR J16385–2057) where water maser emission has been detected, to investigate the interplay between this peculiar class of AGN and the maser phenomenon. In this talk, I will illustrate the main results of this study, including the finding of a water maser detection rate in NLS1 galaxies among the highest ever obtained, so far, in any class of AGN and the possible association of the water maser sources in NLS1 with radio jets or outflows, or with accretion disks having atypical properties.

T. J. TURNER

*Department of Physics, University of Maryland Baltimore County, Baltimore, MD 21250 (USA)*

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## **X-ray Signatures of Circumnuclear gas in AGN**

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 for NLSy1s.



M. VESTERGAARD

*DARK Cosmology Centre, Copenhagen University, 2100 Copenhagen (Denmark)*

and B. Peterson, K. Denney

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## **Black hole mass estimations - limitations and current efforts for improvements**

I suggest to present status of black hole mass estimation, their limitations, especially for NLS1s, and our efforts to improve these. If I have time I will compare the  $L_{bol}/L_{Edd}$  values for broad line and NLS1s and I will take an extra look at the Shen et al. result that high  $L_{bol}/L_{Edd}$  value AGNs, like NLS1s, lie below the  $M - \sigma$  relation.

A. WANDEL

*Racah Institute of Physics, The Hebrew University, Jerusalem 91405 (Israel)*

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## **On the low BH/bulge ratio of NLS1**

Soon after the discovery of the BH-bulge relation in normal galaxies Wandel (1999) has found a similar relation for AGN with Seyfert 1 galaxies on the low end of the  $M_{bh}/M_{bulge}$  ratio. A follow-up work (Wandel 2002) demonstrated that in NLS1s this ratio was about an order of magnitude lower than the quiescent BH/bulge value, while broad-line AGNs had the same ratio as quiescent galaxies. Further correlations between the BH/bulge ratio and AGN emission-line width have been reviewed in the context of BH masses in AGN (Wandel 2008;2009) and will be further interpreted here as an outstanding feature of NLS1.

J.-H. Woo

*Department of Astronomy, Seoul National University (Republic of Korea)*

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## **The overall uncertainty of single-epoch virial black hole mass estimators and its implication to the $M - \sigma$ relation**

Black hole masses (BHM) are one of the key parameter to understand AGN physics and the black hole-galaxy coevolution. Most BHMs are determined using single-epoch spectra based on the virial assumption of the broad-line region (BLR) and the empirical relation of the BLR size with AGN luminosity. Although understanding the uncertainties of single-epoch mass is crucial, the overall uncertainty is not well known. Using the homogeneous high-quality multi-epoch data from the Lick AGN Monitoring Project, we investigate the uncertainties of single-epoch virial BHMs by comparing measurements from single-epoch, mean, and rms spectra. We find that BHMs estimated from single-epoch or mean spectra are systematically larger than those estimated from rms spectra, particularly for objects with narrow-lines ( $\text{FWHM} < 2000 \text{ km/s}$ ). We will discuss the individual sources of uncertainties, the overall uncertainty of the single-epoch mass estimator, and its implication to the  $M - \sigma$  relation.

D. XU

*National Astronomical Observatories, Chinese Academy of Sciences, Beijing, 100012 (China)*

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## **The NLR in narrow-line Seyfert 1 galaxies**

We have rigorously studied the properties of the narrow-line region(NLR) for a sample of narrow-line Seyfert 1 (NLS1) galaxy, and performed a comparison with a sample of broad-line Seyfert 1 (BLS1) galaxies. We find (1) a “zone of avoidance” in density in the sense that BLS1 galaxies avoid low densities, while NLS1 galaxies show a wider distribution in the NLR density, including a significant number of objects with low densities. (2) New correlations and trends which link black hole mass, Eddington ratio and physical parameters of the emission-line region. A new element is added to the eigenvector 1 space based on a principal component analysis, which aims at identifying the main drivers of AGN correlation properties.

A. ZOGHBI

*Institute of Astronomy, Cambridge, CB3 0HA (UK)*

and A. C. Fabian, P. Uttley

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## **X-ray Reverberation delays in NLS1**

NLS1 are known to be highly variable in X-rays indicating an origin in a small region. In many cases, the X-ray spectra show broad iron lines indicating that the emission originate very close to the black hole. Here we present some of the recent work we have been doing in combining these two methods to understand these black holes. In particular, I will report on some of the work on reverberation delays in some extreme object. These delays originate very close to the black hole and measure the light-travel times in that compact region.

# Posters

K. AOKI

*Subaru Telescope, National Astronomical Observatory of Japan, Hilo, HI 96720 (USA)*

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## **Rest optical spectroscopy of FeLoBALs and LoBALs at intermediate redshift**

NLS1s and low-ionization BAL (LoBAL) QSOs appear to share observational properties. We observe H $\beta$  - [O III] region of 20 iron LoBALs and LoBALs at intermediate redshift ( $1.4 < z < 2.5$ ). Many of objects have weak [O III] emission line and moderate optical Fe II emission lines. We will compare black hole mass and Eddington ratio of FeLoBALs/LoBALs to those of non-BAL QSOs.

A. CACCIANIGA

*INAF – Osservatorio Astronomico di Brera, 20121 Milano (Italy)*

and P. Severgnini, A. Corral, R. Della Ceca, R. Fanali, E. Marchese

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## **X-ray selected Narrow-Line Seyfert 1**

We present and discuss the optical and X-ray properties of a new X-ray selected sample of  $\sim 25$  Narrow-line Seyfert 1 derived from the *XMM-Newton Bright Serendipitous Survey* (XBS). The large majority of these sources are newly discovered from dedicated optical spectroscopy. X-ray selected samples provide an independent view of the statistical properties of this peculiar class of AGN which is complementary to the one inferred from optically selected samples.



G. CALDERONE

*Università di Milano Bicocca, Milano (Italy)*

and L. Foschini, G. Ghisellini, M. Colpi, L. Maraschi, F. Tavecchio, R. Decarli, G. Tagli-  
aferrì

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## **Gamma-ray variability of radio-loud narrow-line Seyfert 1 galaxies**

The recent detection of gamma-ray emission from four radio-loud narrow-line Seyfert 1 galaxies suggests that the engine driving the AGN activity of these objects share some similarities with that of blazars, namely the presence of a gamma-ray emitting, variable, jet of plasma closely aligned to the line of sight. In this work we analyze the gamma-ray light curves of the four radio-loud narrow-line Seyfert 1 galaxies for which high-energy gamma-ray emission has been discovered by *Fermi*/LAT, in order to study their variability. We find significant flux variability in all the sources. This allows us to exclude a starburst origin of the gamma-ray photons and confirms the presence of a relativistic jet. Furthermore we estimate the minimum  $e$ -folding variability timescale (3 – 30 days) and infer an upper limit for the size of the emitting region (0.2 – 2 pc, assuming a relativistic Doppler factor of 10 and a jet aperture of 0.1 rad).

N. CASTELLÓ-MOR

*Instituto de Física de Cantabria (IFCA-CSIC), Santander (Spain)*

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## **X-ray properties of a sample of NLS1 selected from the SDSS**

We have assembled an optically selected sample of Narrow-line emission galaxies (NELG), using SDSS DR7 archival data, and imposing  $\text{FWHM}(\text{H}\beta) < 1200$  km/s. We cross-correlated this parent sample with the 2XMMi catalogue, resulting in 337 NELG detected at X-rays. We used this sample to test how many AGN are missed by the classical optical emission line diagnostic diagram (BPT), assuming that all galaxies with an X-ray luminosity  $> 10^{42}$  erg/s host an active nucleus. We find that about 10% of the overall NELG sample would be classified as starburst galaxies, while hosting an AGN according to that assumption. However, we find that these AGNs missed by the BPT diagnostic, turn out to be Narrow-line Seyfert 1 galaxies (NLS1) with broad-line widths ( $600 < \text{FWHM}(\text{H}\beta) < 1200$  km/s). We then go back to our parent NELG sample, and select all galaxies with H $\beta$  between these bounds as a method to construct a sizable sample of  $\sim 60$  NLS1. In this presentation I will present preliminary results on the X-ray spectral properties of this NLS1 sample. The X-ray spectral slopes in the 2 – 10 keV band are steep ( $\Gamma \sim 2$  to 2.7), as expected. Below 2 keV and the spectrum are dominated by a strong excess emission that we are currently characterizing.

C. Y. CHIANG

*Institute of Astronomy, Cambridge, CB3 0HA (UK)*

and A. C. Fabian

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## **Modelling the Full X-ray Spectra of MCG $-6 - 30 - 15$ with a Relativistic Reflection Model**

The AGN MCG  $-6 - 30 - 15$ , which shares many similarities with NLS1 galaxies, shows a broad Fe  $K\alpha$  line that is generally explained as reflection from the inner part of an accretion disc around a fast spinning black hole. The flux of the line was expected to follow that of the powerlaw component, but little variability was found. The disconnection of continuum and line variability may be caused by strong gravitational light bending. However, some workers have built an absorption model and attribute most variability to the warm absorbers. They claim relativistic reflection is not needed to explain the source behaviour and the hard excess. We re-examine the *XMM*, *Chandra* and *Suzaku* data taken in different epochs and construct a model consisting of several warm absorbers, together with a relativistic reflection component that explains both the soft and hard excesses. Our model works well on all data, implying it provides a consistent interpretation of the broadband spectrum of MCG  $-6 - 30 - 15$ .

D. DULTZIN

*Instituto de Astronomía, Universidad Nacional Autónoma de México, C.P. 04510 (México)*

and P. Marziani, J. W. Sulentic

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## **Narrow-Line Seyfert 1s: a luminosity dependent definition**

Do sources equivalent to NLSy1s in the local Universe exist at high redshift and luminosity? The answer is “yes”. A fraction of quasars at  $z \sim 3$  show rest frame UV spectra that bear a striking resemblance to the one of the NLSy1 prototype I Zw 1. We derive their physical properties, and found them consistent with the ones of I Zw 1. A fixed limit on line FWHM, customarily set to 2000 km/s on  $H\beta$  at low- $z$  is however inadequate to describe high- $z$  luminous NLSy1s. Objects with  $\text{FWHM} < 2000$  km/s become impossible at high luminosity unless they are significantly super-Eddington and the virial assumption is violated. The minimum FWHM of NLSy1s-like low-ionization lines is expected to increase monotonically with luminosity and to even become larger than 2000 km/s, making it necessary to introduce a luminosity-dependent FWHM upper limit for their definition.

J. R. EGGEN

*Department of Physics and Astronomy, Georgia State University, Atlanta, GA 30303, (USA)*

and H. R. Miller, J. D. Maune

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## **Optical Polarization Observations of RL NLS1 Galaxies**

Recently, there has been much interest focused on a small but interesting subclass of AGN, the very radio loud NLS1s ( $R > 100$ ). Several of these objects have been observed to possess blazar-like properties, including blazar-like SEDs and the emission of gamma rays, as detected by the *Fermi*/LAT instrument. As part of our ongoing program, we are now reporting on observations of a limited sample of RL NLS1s. We have obtained polarimetric observations of these objects in an effort to determine if they exhibit the large and variable polarization similar to that found for blazars. We also utilize the public data available from the *Fermi*/LAT instrument to determine if and to what degree these objects may be gamma ray loud and variable. The the results for the observations for these objects will be compared to the typical properties of blazars.

T. FISCHER

*Department of Physics and Astronomy, Georgia State University, Atlanta, GA 30303, (USA)*

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## **Are Narrow-Line Seyfert 1 Galaxies Viewed Pole-on?**

Current attempts to dissect the inner workings of Narrow-Line Seyfert 1 galaxies (NLS1s) rely on the concept that the narrow widths of their permitted lines are due to low central black hole masses resulting in high Eddington ratios. Could these narrow lines instead be due to a near pole-on orientation? We analyze spatially resolved spectra of 3 NLS1s using the HST STIS G430M grating centered on the bright [OIII] emission lines to model the NLR outflows and determine their inclinations.

C. GRIER

*Department of Astronomy, The Ohio State University, Columbus, OH 43210 (USA)*

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## **New Results in Reverberation Mapping**

We have completed observations for a 125-night reverberation mapping campaign to measure new or improved black hole masses in seven AGN. From these observations we can further constrain broad line region (BLR) kinematics and improve the observed relation between the radius of the BLR and the AGN luminosity (the  $R - L$  relation), which allows us to accurately estimate black hole masses for large samples of AGN. High-quality reverberation mapping datasets are difficult to obtain, as well-spaced observations over long timescales are required. Some reverberation campaigns in the past have not yielded satisfactory results due to inadequate time sampling; this campaign is part of a larger effort to improve the reverberation mapping database.

D. GRUPE

*Department of Astronomy and Astrophysics, Pennsylvania State University, University Park, PA 16802 (USA)*

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## **WPVS 007 and Mkn 335: The link between NLS1s and BAL QSOs**

We will report on the results from our most recent *XMM* and *Swift* observations of the Narrow Line Seyfert 1 galaxies WPVS 007 and Mkn 335. The X-ray transient AGN WPVS 007 was an X-ray bright source during the *ROSAT* All-Sky Survey, but basically disappeared from the X-ray sky for almost two decades. *Fuse* observations in 2003 revealed the nature of this disappearance: strong absorption. *Fuse* spectra showed deep absorption line troughs in the UV spectrum of WPVS 007. These findings make this AGN a direct link between NLS1s and Broad Absorption Line QSOs which are both thought to be high  $L/L_{Edd}$  AGN. In the recent year *Swift* was able to detect WPVS 007 in X-ray at relatively bright states several times, suggesting that the absorber may have started to disappear. In some ways similar is the NLS1 Mkn 335 which has been observed in X-ray in a bright state over decades, but was found by *Swift* in an extremely low state in May 2007. Our *XMM* observation from June 2009 show the presence of a strong ionized partial covering absorber in the X-ray data of Mkn 335.



K. HRYNIEWICZ

*Nicolaus Copernicus Astronomical Center, 00-716 Warsaw, Poland*

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## **Is the SDSS J094533.99+100950.1 higher mass equivalent to narrow-line Seyfert 1 galaxies?**

SDSS J094533.99+100950.1 is an example of a weak line quasar (WLQ). A few hypotheses explaining WLQ phenomena are present in the literature. One of them is that WLQs are similar to the PHL 1811 lineless NLS1. What PHL 1811 and WLQ have in common are very low equivalent widths of the high-ionization emission lines like CIV or HeII, typical iron emission, radio quiescence and X-ray weakness. The explanation of untypical quasar properties could be super-Eddington accretion rate. In addition, the ionizing radiation can be obscured by wind or other medium on its way to the broad emission line region (BLR) (Leighly et al.). Another possibility is that due to evolution of active phase in AGN the emitting matter can have unusual properties. The BLR could not be fully developed in the state before the wind is launched, thus occupying compact region. To resolve the puzzle we have done spectral analysis, photoionization simulations, accretion disk continuum fitting and black hole spin estimation.

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## **Radio properties of Narrow-Line Seyfert 1 Galaxies**

I will give an overview of the radio properties of Narrow-line Seyfert 1 (NLS1) galaxies. The first systematic studies of these galaxies in the radio band have, in particular, led to the following key conclusions: (a) NLS1 galaxies as a class are less likely to be radio-loud than broad-line Seyfert 1 (BLS1) galaxies. Especially, there is a strong deficiency of NLS1 galaxies at the highest values of radio loudness (as measured by the classical radio index  $R$ ). Radio morphology is generally very compact, and sources show some similarity with classical compact steep-spectrum sources (CSS). (b) Among the radio-loudest NLS1s, several exhibit radio evidence for relativistic beaming, and display other blazar-type behavior. Implications for models of NLS1 galaxies, accretion modes in these objects, and the radio-loud radio-quiet dichotomy of AGN will be discussed.

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## **Inhomogeneous Partial Covering in Markarian 766**

Two types of variability were found in the rapidly varying narrow-line Seyfert 1 galaxy, Markarian 766. The long-term variability and its associated spectral flattening seen in two observations are caused by a thick partially covering cloud and variable emission region. However the average spectral behavior shows partial covering of a thinner cloud. The result is an inhomogeneous cloud that partially covers the source. When the source is dim a thicker portion of the clouds covers it, but as the source brightens and enlarges the thinner portion plays a more dominant role in the covering. The short, rapid variability is caused by the combination of a highly variable power law component and a stable reflected component, referred to here as ionized relativistic reflection.

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## **The properties of nearby BL Lac Objects with optical jets**

We investigate the properties of the only three BL Lac objects, PKS 0521–365, PKS 2201+044, and 3C 371, that exhibit prominent optical jets. We present new high resolution near-IR images of the jet of the first two, obtained with an innovative adaptive-optics system (MAD) at ESO VLT telescope. We compare the NIR jet morphology with that observed in the radio, optical and X-ray bands that reveals strong similarities. A common property of these sources is the presence of emission lines in their optical spectra at variance with the typical featureless spectrum of the BL Lac class. Comparison with characteristics of NLS1 is illustrated.

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## **A Search for Rapid Optical Variations in Very Radio-Loud Narrow-Line Seyfert Galaxies**

Recent observations appear to indicate fundamental similarities in the nature of the properties of the class of objects known as very radio-loud narrow-line seyfert 1 (RLNLSy1) galaxies (defined as having a radio loudness  $R > 100$ ) and blazars. We report the first results of optical monitoring of the variability of a small sample of RL NLSy1 galaxies on timescales ranging from hours to days. The observed variability will be compared to that found for typical blazars. These results will be used to investigate the possible relationship between RLNLSy1 galaxies and blazars. A further comparison between RLNLSy1 and radio-quiet NLSy1 galaxies is made in an attempt to determine the dependence of the variability on radio loudness.

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## **Narrow Emission Line Galaxies – not Seyfert 1 – with low mass black holes accreting at maximum rates, close to the Eddington limit**

Among the different hypothesis proposed to explain narrow line Seyfert 1 galaxies, one assumes they are low mass black holes accreting at maximum rates. In our on going analysis about the origin of the AGN phenomenon in isolated galaxies, we have confirmed that the probability to find an AGN increase with the bulge mass of the galaxy (Torres-Papaqui et al. 2011). However, although we observe a high fraction of AGNs, the majority turns out to be narrow line Seyfert 2 and LINERs galaxies. Using the relation  $M_{BH}-\sigma$ , where  $\sigma$  is the velocity dispersion of the stars as determined by STARLIGHT, and comparing with the luminosity at 5100 Å we have found that these AGNs may already have small mass black holes ( $10^6$  to  $10^7 M_{\odot}$ ) accreting at high rates, close to the Eddington limit. This observation may suggest that some evolutionary connection does exist between the narrow line Seyfert 1, the Seyfert 2 and LINERs, possibly similar to what we have proposed to explain LLAGNs (dying quasar) in compact groups and clusters of galaxies.

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## **A preliminary census of soft excess occurrence from a small sample of RL-NLSy1**

About two-dozen very Radio loud NLSy1 have been proposed as blazar candidates in 2008 By Yuan and collaborators. The detection in gamma-rays of a few RL-NLSy1, has confirmed the blazar-like nature of the objects and suggested that RL-NLSy1 are a new class of AGN. With this starting point, we analyse archival x-ray observations of RL-NLSy1s with the goal of finding similarities and differences with respect to the well x-ray characterized population of Radio quiet NLSy1s. We focus here on the soft excess contribution to x-ray spectra, and on the comparison with the power-law contribution. This study can give us some hints on the (NL)Sy1- and blazar-like contribution to x-ray emission of RL-NLSy1.

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## **X-ray study of Narrow Line Seyfert 1 galaxies with strong Fe II emission**

The strength of Fe II emission is an important AGN parameter: from being almost undetectable in lobe-dominated QSOs and BLRGs to being the most prominent feature in the optical spectra of some radio-quiet QSOs and Seyfert galaxies, Fe II can account for up 1/3 of the line emission. We report preliminary results on our *XMM-Newton* observations of a sample of four Narrow Line Seyfert galaxies with strong Fe II emission (i.e.  $\text{FeII } 4570/\text{H}\beta > 1.5$ ).



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## **Implications from the optical to UV flux ratio of Fe II emission in SDSS DR7 quasars**

We have investigated Fe II emission by analysing SDSS DR7 quasars. We have chosen those quasars UV and optical Fe II emissions of which are simultaneously covered by SDSS, resulting in 1,400 sources whose redshifts range from 0.73 to 0.80 and absolute i magnitudes from  $-24$  to  $-26$ . We found that narrow line objects, such as Narrow Line Seyfert 1 galaxies (NLSy1s), have large optical to UV Fe II flux ratios, indicating that they have large column density BLR clouds (Sameshima et al. 2010). Combining this result with high Eddington ratios found in NLSy1s, it can be naturally interpreted that the radiation pressure of photons emitted from the central source controls the state of BLR clouds. We also find that Fe II emission must emerge from the outermost region of BLR clouds in such a way that they are not radiatively blown away. Finally, we introduce our project to measure the iron abundance in BLR clouds combining X-ray with optical observations.

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## **High-energy emission from NGC 5506, the brightest hard X-ray NLS1**

While in the soft X-rays NLS1 show characteristics that distinguish them clearly from broad line objects, the hard X-ray properties of NLS1 are not yet well defined, as only a handful of objects has been studied in detail up to now. We present a study of NGC 5506, the brightest NLS1 galaxy at hard X-rays, that was simultaneously observed by the *INTEGRAL* and *Swift* satellites during 2010. This data set (together with *Suzaku* data) allows us to reconstruct the high-energy emission of this AGN in the broad X-ray band from 0.5 to a few hundred keV, investigate the presence of Comptonisation signatures and study the hard X-ray variability of this object. Compton reflection and a low electron plasma temperature around 40 keV are measured, comparable to what it is found in other NLS1, while the intrinsic spectrum is harder than in other objects of the same class. We will discuss the properties of this Seyfert in comparison with the average properties of NLS1 and BL Seyfert at hardest X-rays.

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## **Variability, optical-to-X-ray slope and accretion disc properties in a sample of Seyfert 1s**

The spectral index connecting 2500 angstrom and 2 keV emission ( $\alpha_{OX}$ ) correlates with UV luminosity in AGN, providing a probe of their energy output from accretion. Some NLS1 AGN with spectral complexity have been found to deviate from this relation, and the effects of variability have not yet been studied in detail. We present an analysis of simultaneous SEDs from *XMM-Newton* (using the PN and OM instruments) for 97 low-absorption Seyfert 1s, including a substantial fraction of NLS1 AGN. Multiple observations are available for 31 objects from the sample; the effects of variability on determination of  $\alpha_{OX}$  and other SED parameters can then be studied. Using simple accretion disc model fits to the simultaneous SED data, we revisit questions such as whether NLS1s are accreting at higher accretion rates, and explore whether the accretion disc properties (temperature, inner disc radius) for NLS1s show any systematic differences between normal Seyfert 1s and NLS1s

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## **MERLIN 18cm observations of intermediate redshift NLS1 galaxies**

We will present MERLIN/EVN observations of 13  $z \sim 0.2$  X-raying AGN. The targets are based on matching SDSS/*ROSAT*/FIRST databases and present a mixture of AGN types, five of which are NLS1s. At 18 cm, typical linear scales of 500 pc (MERLIN) and 40 pc (EVN) are reached. All NLS1s have compact cores, show no kpc scale jets, and are radio intermediate  $R^* \approx 0.8$ . The NLS1s in our sample are characterized by small black hole masses of around  $10^7 M_\odot$  and high Eddington ratios around 0.45. Using various star-formation indicators from the radio to the optical shows that the radio emission is always dominated by the AGN. We will put the results for the NLS1s in context with the other AGN types of our sample (Seyfert 1, LINER, BL LAC, radio galaxy) and the evolutionary paradigm.

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Updated on April 1, 2011

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