REPORT ON THE RADIONET3 NETWORKING ACTIVITY

TITLE: NUCLEI OF SEYFERT GALAXIES AND QSOS - CENTRAL ENGINE & CONDITIONS OF STAR FORMATION

DATE: *6. – 8. NOV. 2012* **TIME:** (WHOLE DAY)

LOCATION: *BONN, GERMANY*

MEETING WEBPAGE http://www.astro.uni-koeln.de/Seyfert2012

HOST INSTITUTE: *I. PHYSIKALISCHES INSTITUT, UNIVERSITÄT ZU KÖLN &*
MAX-PLANCK-INSTITUT FÜR RADIOASTRONOMIE

PARTICIPANTS NO: *90*

Project supported by the European Commission
Contract no.: 283393

REPORT:

1. Agenda and/or programme of the meeting

Please include the detailed agenda / programme of the event, including the title of the presentations and speakers (name/institutes/countries) when possible.

Please see Sect. 3 for affiliations.

Tuesday, Nov. 6

Session 1: Nearby galaxies and the Galactic Center
(Chairperson: S. Komossa)

09:00 S. Komossa, Welcome
09:15 C. Mundell, Galaxies and their nuclei (review)
09:45 M. Vitale, A statistical study on SDSS radio emitters
10:00 R. Capuzzo Dolcetta, The dense stellar systems around galactic massive black holes
10:15 A. Eckart, The Galactic Center as a paradigm for low-luminosity nuclei ?
10:30 M. Schartmann, Simulations of the origin and fate of the Galactic Center cloud G2
10:45-11:15 coffee break and poster viewing
11:15 A. Prieto, The central parsec of galaxies in the IR
11:30 D. Asmus, Mid-infrared properties of local active galactic nuclei at high-angular resolution
11:45 M. Bremer, The central 3 kpc of NGC 5850
12:00 S. Smajic, The central kiloparsec of edge-on AGN

12:15-14:00 lunch (reservation at MPIfR canteen: 12:45-14:00)

Session 2: Narrow-line Seyfert 1 galaxies
(Chairperson: B. Peterson)

14:00 L. Foschini, Powerful relativistic jets in narrow-line Seyfert 1 galaxies
14:30 D. Xu, NLS1 galaxy correlation space
14:45 A. Rodriguez-Ardila, Near-infrared FeII emission in IZw1 and other NLS1 galaxies

15:00 D. Ilic, The variability of the optical spectra of three type 1 AGNs

15:15-15:45 coffee break and poster viewing
15:45 M. Ward, A new determination of black hole spin for a NLS1
16:00 C. Done, Low black hole spin in some Narrow line Seyfert 1s
16:15 G. Orban de Xivry, Secular evolution in NLS1 galaxies and the growth of their black holes
16:30 M. Valencia-S, IRAS 01072+4954: A low-mass black hole with high accretion rate = NLSy1?
16:45 J. Zuther, NLS1s in a sample of low-z type-1 QSOs

Wednesday, Nov. 7

Session 3: Outflows, jets and feedback
(Chairperson: M. Ward)

09:00 R. Morganti, Outflows, feedback, jets (review)
09:30 F. Hamann, The physics and physical properties of quasar outflows
09:45 Z. Paragi, Jet scaling relations in LLAGN: A VLBI view
10:00 M. Karouzos, Star-formation in the host galaxies of radio-AGN
10:15 L. Fuhrmann, The radio/gamma-ray connection: cm to short-mm band radio and gamma-ray correlated variability in Fermi bright blazars
10:30 B. Rani, Rapid variability: what do we learn from correlated mm-/gamma-ray variability in jets ?
10:45-11:15 coffee break and poster viewing
11:15 B. Husemann, The lack of QSO outflows and the suppression of star formation in Seyfert galaxies
11:30 A. Tsai, The kpc-scale molecular outflows in two nearby starburst galaxies, NGC 2146 and NGC 3628
11:45 A. Shulevski, AGN life cycles - the low frequency story as told by LOFAR
12:00 J.A. Fernández Ontiveros, The nature of the IR emission in LLAGNs at parsec scales: does the jet dominate at low luminosities?

12:15-14:00 lunch (reservation at MPIfR canteen: 12:45-14:00)

Session 4: Seyferts and QSOs: BH masses, scaling relations, and star formation
(Chairperson: H. Netzer)

14:00 L. Wisotzki (review)
14:30 B. Peterson, Masses of Black Holes in Active Galactic Nuclei
14:45 J.-H. Woo, Do AGN and non-AGN galaxies have different M-sigma relations?
15:00 J. Kotilainen, Quasar host galaxies and environments in the SDSS Stripe 82
15:15-15:45 coffee break and poster viewing
15:45 K. Tristram, The properties of dusty tori in active galactic nuclei revealed by infrared interferometry
16:00 Y. Toba, Luminosity dependent covering factor of the dust torus around AGN viewed with AKARI and WISE
16:15 F. Pozo, Photometric reverberation mapping of 3C120
16:30 C. Bruckmann, Modelling reverberation data of 3C120 - evidence for a disk like BLR
16:45 S. Raimundo, Probing the inner regions of MCG-06-30-15: the link between AGN activity and star formation
17:00 H. Flohic, Structure of the accretion flow at low accretion rates

19:30 Buffet dinner at the Chinese “Ocean Paradise”

Thursday, Nov. 8

Session 4, cont’d: Seyfert galaxies and QSOs
(Chairperson: C. Mundell)

09:00 E. Bottacini, AGN in the local universe with the SIX survey: evolution and circum-nuclear environment
09:15 G. La Mura, Nuclear activity and stellar mass in galaxies
09:30 L. Popovic, Spectral properties of a sample of type 1 AGNs: influence of star

formation
09:45 P.-C. Yu, Testing the evolutionary sequence between hidden broad line region (HBLR) and non-HBLR Seyfert 2 galaxies

Session 5: Galaxy mergers on all scales
(Chairperson: C. Mundell)

10:00 A. Alonso-Herrero, AGN and star formation activity in local luminous and ultraluminous infrared galaxies (review)
10:30 C. Villforth, Morphologies of low-redshift AGN host galaxies: what role does AGN luminosity play?
10:45-11:15 coffee break and poster viewing
11:15 S. König, The anatomy of polar ring minor merger systems: NGC 1614
11:30 M. Mezcua, Merger-triggered AGN activity and binary SMBHs in the local universe: X-shaped radio galaxies and double-nucleus disk galaxies
11:45 D. Dicken, Star formation and mergers in nearby radio galaxies
12:00 S. Britzen, Searching for supermassive binary black holes with VLBI

12:15-14:00 lunch (reservation at MPIfR canteen: 12:45-14:00)

Session 6: Star formation and accretion at high redshift
(Chairperson: A. Eckart)

14:00 H. Netzer, Star formation and BH accretion at high redshift (review)
14:30 K. Denney, Measuring black hole masses at high redshift
14:45 D. Rosario, Star-formation in active galaxies to z~2: a perspective from Herschel studies
15:00 C. Collet, Mechanical AGN feedback, from very powerful to moderately strong high-redshift radio galaxies
15:15-15:45 coffee break and poster viewing
15:45 F. Carrera, Submm-bright QSOs at z~2: signposts of co-evolution at high z
16:00 S.X. Wang, AGN in submm galaxies - combining the power of Chandra and ALMA
16:15 M. Symeonidis, AGN in dusty hosts: implications for galaxy evolution
16:30 T. Urrutia, Feedback and accretion in young luminous quasars
16:45 D. Sluse, Probing the inner structure of distant AGNs with gravitational lensing
17:00 E. Angelakis, Properties of the radio jet emission of gamma-ray Narrow Line Seyfert 1s
17:15 farewell

2. Scientific Summary

The workshop “Nuclei of Seyfert galaxies and QOSs: Central engine and conditions of star formation” was anticipated to be a timely international meeting in the research field of active galaxies (AGN) and the interplay between the host galaxies and their central supermassive black hole (SMBH).

The workshop was very successful in terms of the number of participants (90) and the broad coverage of related topics. The workshop was also very well received by the participants. Topics ranged from the closest SMBHs (incl. the Galactic Center) out to high redshift AGN (cf., Sect. 1). The organizers were able to attract community-known colleagues to present reviews on the state-of-the-art of the individual subtopics. Furthermore, many international young researchers (PhD students and postdocs) were attracted to the workshop, which allowed for

fruitful discussions after the individual oral presentations and during the breaks (incl. poster presentations). This shows that the field is very lively and it became clear that the advent of high angular resolution across the electromagnetic spectrum (adaptive-optics assisted integral field spectroscopy [e.g., ESO-SINFONI and Gemini NIFS], very long baseline interferometry [VLBI]), as well as, of massive panchromatic galaxy surveys (e.g., COSMOS, SDSS) open up new views on the galaxy/AGN population, and allow to improve our understanding of their cosmic evolution. Special mention should go to presentations of results of the new ESO-ALMA interferometer and space-based telescopes like Herschel and WISE.

A key theme during the session on *nearby galaxies* was the quest for ever higher angular resolution; achievable in the radio regime, or in the infrared by interferometric methods, tracing regions of the scale of a few pc, and allowing to resolve the molecular torus in a couple of the nearest AGN. Current results on the closest galactic nucleus, the Galactic Center (GC) were presented, in particular the object (potential gas/dust cloud), which is approaching the GC mid of next year and we probably will be able to witness its tidal disruption in the gravitational potential of the SMBH at the Galactic Center.

One session focussed on the *class of NLS1 galaxies*, with their extreme multi-wavelength properties; especially the recent discovery of relativistic jets in a fraction of them, seen in the radio and gamma-ray regime. The question what drives them is still open. Other contributions focused on the remarkable multi-wavelength properties of NLS1s, concluding that high Eddington ratios and host properties (low NLR density) are major factors. Further, a new accretion-disk model was presented, which was then used to infer SMBH spin, based on spectral energy distributions, with the surprising result, that SMBH spin is very low.

One session was devoted to *jets, outflows and feedback*. Feedback appears to play a major role in explaining the SMBH/host scaling relations, and a key question has been, whether radiative feedback (from an accretion disk), or mechanical feedback from radio jets is the dominant mechanism. Results presented at the workshop indicate that both modes are important. For instance, a sample of high-redshift radio-galaxies shows extreme emission-line outflows, and the jets turn out to be powerful enough to drive them.

One major theme was SMBH-mass estimates, SMBH / host-galaxy scaling relations, and possible drivers of the (co-)evolution of galaxies and their SMBHs (*Seyferts and QSOs*). The status on measuring SMBH masses from "reverberation mapping" was reviewed. While there are now about 30 nearby AGN with relatively well determined BH masses, a much larger database is needed for careful calibration. While spectroscopic reverberation mapping is time consuming, results from the new method of "photometric reverberation mapping" were presented in two contributions.

Concerning the SMBH/host scaling relations, three key questions were discussed, with the following answers:

- *Do active and non-active galaxies show the same relation?* Likely, yes.
- *Is there a dependence on SMBH mass?* There is some evidence, that SMBHs are over-massive in the largest hosts
- *Is there an evolution with redshift, as has been previously claimed?* This is still uncertain; indications for deviations can well be due to selection effects.

A key theme in the AGN session, including the *high redshift* session was the question, how AGN activity is triggered; especially whether mergers are important/required. This was addressed by studying the nearest neighbour statistics, or by measuring the structure of the host galaxy (disturbed morphologies from mergers vs. bar fraction). The conclusion was that there is apparently no unique mechanism that triggers AGN activity, but several are at work. Mergers dominate at the highest AGN luminosities. Furthermore, some evidence for recurring

activity in radio galaxies was presented (i.e., more than one phase of activity), and it was discussed, how this question can be further addressed with LOFAR.

A further session was dedicated to *galaxy mergers*. A key question was related to the power mechanism of luminous and ultra-luminous IR galaxies (star formation vs. AGN). Usually, star formation dominates, while at higher IR luminosities, AGN become more important. Another topic was the search for supermassive binary BHs (BBHs), and the challenges faced when interpreting light curves and jet-structures to uniquely identify BBHs.

Photo. Courtesy Beate Naunheim

3. Attendance list (incl. participant names, affiliation and country) signed by the participants and confirmed by the organizer

In case of heavy burden with collecting all participant signatures, an attendance list confirmed only by the organizer could be accepted

Almudena	Alonso-Herrero	Instituto de Física de Cantabria, Spain
Emmanouil	Angelakis	Max-Planck-Institut für Radioastronomie, Germany
Daniel	Asmus	Max-Planck-Institut für Radioastronomie, Germany
Eugenio	Bottacini	Stanford University, USA
Marcus	Bremer	I. Physikalisches Institut, Universität zu Köln, Germany
Silke	Britzen	Max-Planck-Institut für Radioastronomie, Germany
Christoph	Bruckmann	Astronomisches Institut, Ruhr Universität Bochum, Germany
Johannes	Buchner	Max-Planck-Institut für extraterrestrische Physik, Germany

Gerold	Busch	I. Physikalisches Institut, Universität zu Köln, Germany
Roberto	Capuzzo Dolcetta	Dep. of Physics, Sapienza, Università di Roma, Italy
Francisco J.	Carrera	Instituto de Física de Cantabria (CSIC-UC),Spain
Stefano	Ciroi	Dept. of Physics and Astronomy, Padova University, Italy
Cedric	Collet	Institut d'Astrophysique Spatiale, France
Erin	Cooper	Homer L. Dodge Department of Physics and Astronomy, The University of Oklahoma, USA
Valentina	Cracco	Dept. of Physics and Astronomy, Padova University, Italy
Kelly	Denney	Dark Cosmology Centre, Niels Bohr Institute, Denmark
Dan	Dicken	Institut d'Astrophysique Spatiale, Université Paris-Sud, France
Chris	Done	Department of Physics, University of Durham, United Kingdom
Xiaoyi	Dong	York University, Canada
Andreas	Eckart	I. Physikalisches Institut, Universität zu Köln, Germany
Andrey	Ermash	Lebedev Physical Institute of Russian Academy of Science, Russia
Heino	Falcke	Radboud University Nijmegen/ASTRON/MPIfR, The Netherlands
Juan Antonio	Fernández Ontiveros	Max-Planck-Institüt für Radioastronomie, Germany
Sebastian	Fischer	I. Physikalisches Institut, Universität zu Köln, Germany
Helene	Flohic	Universidad de Chile, Chile
Luigi	Foschini	INAF Osservatorio Astronomico di Brera, Italy
Lars	Fuhrmann	Max-Planck-Institut für Radioastronomie, Germany
Fred	Hamann	University of Florida, USA
Antonio	Hernán-Caballero	Instituto de Física de Cantabria, Spain
Bernd	Husemann	Leibniz-Institut für Astrophysik Potsdam, Germany
Dragana	Ilic	Department of Astronomy, Faculty of Mathematics, Serbia
Christof	Iserlohe	I. Physikalisches Institut, Universität zu Köln, Germany
Vassilis	Karamanavis	Max-Planck-Institut für Radioastronomie, Germany
Marios	Karouzos	Seoul National University, Seoul, Republic of Korea
Wolfram	Kollatschny	Institute for Astrophysics, Göttingen University, Germany
Stefanie	Komossa	Max-Planck-Institut für Radioastronomie, Germany
Sabine	König	IRAM, France

Jari	Kotilainen	Finnish Centre for Astronomy with ESO (FINCA), University of Turku, Finland
Annika	Kreikenbohm	Lehrstuhl für Astronomie, Universität Würzburg, Germany
Giovanni	La Mura	University of Innsbruck - Institut für Astro- und Teilchenphysik, Austria
Lucas	Labadie	I. Physikalisches Institut, Universität zu Köln, Germany
Taeseok	Lee	Seoul National University, Republic of Korea
Mar	Mezcua	Instituto de Astrofisica de Canarias, Spain
Takamitsu	Miyiaji	IA-UNAM-Ensenada & UCSD/CASS, USA
Raffaella	Morganti	Netherlands Institute for Radio Astronomy, Dwingeloo, The Netherlands
Lydia	Moser	I. Physikalisches Institut, Universität zu Köln, Germany
Jihane	Moultaka	IRAP - Observatoire Midi-Pyrénées 14, France
Carole	Mundell	Astrophysics Research Institute, Liverpool John Moores University, United Kingdom
Ioannis	Myserlis	Max-Planck-Institut für Radioastronomie, Germany
Hagai	Netzer	School of Physics and Astronomy, Tel Aviv University, Israel
Junghwan	Oh	SNU, Korea
Gilles	Orban de Xivry	Max-Planck-Institut für extraterrestrische Physik, Germany
Zsolt	Paragi	Joint Institute for VLBI in Europe (JIVE), The Netherlands
Bradley	Peterson	Ohio State University, Department of Astronomy, USA
Jana	Polednikova	Instituto de Astrofisica de Canarias, Spain
Luka	Popovic	Astronomical Observatory Belgrade, Serbia
Francisco	Pozo	Astronomisches Institut, Ruhr Universität Bochum, Germany
Almudena	Prieto	IAC, Tenerife, Spain
Piero	Rafanelli	Department of Physics and Astronomy University of Padova, Italy
Sandra	Raimundo	SISSA, Italy
Jose M	Ramirez	Instituto Venezolano de investigaciones Científicas (IVIC), Venezuela
Bindu	Rani	Max-Planck-Institut für Radioastronomie, Germany
Alberto	Rodriguez-Ardila	Laboratorio Nacional de Astrofisica, Brazil
David	Rosario	Max-Planck-Institut für extraterrestrische Physik, Germany

Jessie	Runnoe	University of Wyoming, Department of Physics & Astronomy, USA
Nadeen	Sabha	I. Physikalisches Institut, Universität zu Köln, Germany
Marc	Schartmann	Max-Planck-Institut für extraterrestrische Physik & USM, Germany
Banafsheh	Shahzamanian	I. Physikalisches Institut, Universität zu Köln, Germany
Aleksandar	Shulevski	Kapteyn Astronomical Institute, Groningen University, The Netherlands
Elena	Sissa	Università degli Studi di Padova - Dipartimento di Fisica e Astronomia, Italy
Dominique	Sluse	Argelander Institut fuer Astronomie, Germany
Semir	Smajic	I. Physikalisches Institut, Universität zu Köln, Germany
Myrto	Symeonidis	MSSL-UCL, United Kingdom
Yoshiki	Toba	The Graduate University for Advanced Studies (SOKENDAI), ISAS/JAXA, Japan
Konrad	Tristram	Max-Planck-Institut für Radioastronomie, Germany
An-Li	Tsai	Graduate Institute of Astronomy, National Central University, Taiwan
Tanya	Urrutia	Leibniz Institut fuer Astrophysik, Potsdam, Germany
Monica	Valencia-S.	I. Physikalisches Institut, Universität zu Köln, Germany
Beatriz	Villarroel	Department of Physics and Astronomy, Ångströmlaboratoriet, Sweden
Carolin	Villforth	University of Florida, USA
Mariangela	Vitale	I. Physikalisches Institut, Universität zu Köln, Germany
Sharon Xuesong	Wang	Dept. of Astronomy & Astrophysics, Penn State University, USA
Martin	Ward	Durham University, United Kingdom
Lutz	Wisotzki	Leibniz-Institut für Astrophysik Potsdam, Germany
Jong-Hak	Woo	Seoul National University, Republic of Korea
Dawei	Xu	National Astronomical Observatories, China
Po-Chieh	Yu	Graduate Institute of Astronomy, National Central University, Taiwan
Mohammad	Zamaninasab	Max-Planck-Institut für Radioastronomie, Germany
Anton	Zensus	Max-Planck-Institut für Radioastronomie, Germany
Matthias	Zetzl	Institut für Astrophysik, Universität Göttingen, Germany
Jens	Zuther	I. Physikalisches Institut, Universität zu Köln, Germany

4. **Financial Report / RadioNet3 contribution**.

The RadioNet3 contribution to the workshop encompassed travel support for a few young researchers and amounts to 1100€.

We awarded the available funding to seven participants, reflecting the distribution of countries. With the funds, we could cover the workshop fee for every of the seven participants.
For two of the participants, we used the remaining 400€ (200€ each) for travel support.

Mar Mezcua (100 EUR fee)
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Eugenio Bottacini (100 EUR fee)
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Po-Chieh Yu (300 EUR = 100 EUR fee + 200 EUR travel)
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Sharon Xuesong Wang (300 EUR = 100 EUR fee + 200 EUR travel)
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5. Conference Proceedings and Web page

The workshop webpage is http://www.astro.uni-koeln.de/Seyfert2012.
Proceedings of the workshop will be published online in “Proceedings of Science”. The proceedings web page is http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=169.
The current deadline for submission of contributions is 31st of January 2013.

The organizers introduced a list of “key questions” (http://www.astro.uni-koeln.de/node/718), which were/are supposed to trigger a critical discussion about important issues in the field of AGN research. The participants were asked to address the questions in their proceedings contribution or send the organizers a dedicated email. The goal is to provide a conference summary article compiling the views and showing up possibilities for synergies and/or new approaches to certain aspects.

1. What have we learned from observations of the Galactic center and the nearby galaxies about accretion onto SMBHs, circumnuclear star formation and their relation?

2. Are NLS1s a “special class” of AGN?

3. How are jets and outflows related to the accretion radiative efficiency and the black hole spin?

4. What is the structure of the BLR and how is it connected to the (toroidal) obscuration?

5. How much can we trust the different black hole mass estimation methods?

6. Do non-HBLR exist or is the lack of broad lines in these objects a matter of observational biases (e.g., spatial resolution, sensitivity)?

7. What is the character of the AGN - star formation relation at low/high redshifts: coincidental, causal, self-regulated?