PARTICIPANTS

Abhijeet Borkar
I Physikalisches Institut, University of Cologne
borkar@ph1.uni-koeln.de

Adam Larkin
Keele University
a.larkin@keele.ac.uk

Agnese Del Moro
Durham University
agnese.del-moro@durham.ac.uk

Alberto Rodíguez Ardila
Laboratorio Nacional de AstrofÌsica
aardila@lna.br

Alejandra Melo Melo
Universidad de Concepción
alejandramelo@udec.cl

Aleksandar M. Diamond-Stanic
University of Wisconsin
aleks@astro.wisc.edu

Alex Dunhill
PUC
adunhill@astro.puc.cl

Alexander Mendez
Johns Hopkins University
ajmendez@jhu.edu

Alison Coil
University of California San Diego
acoil@ucsd.edu

Amanda Schilling
University of Arkansas, Fayetteville
aschilli@uark.edu

Amy Kimball
CSIRO Astronomy & Space Science
Amy.Kimball@csiro.au

Amy Reines
University of Michigan
reines@umich.edu

Andrea Comastri
INAF-Osservatorio Astronomico di Bologna
andrea.comastri@oabo.inaf.it

Andreas Schulze
Kavli IPMU
andreas.schulze@ipmu.jp

Andres Escala

Anirban Bhattacharjee
Sul Ross State University/University of Wyoming
anirbanbhattacharjeee@gmail.com

Anne Lahteenmaki
Aalto University Metsahovi Radio Observatory & Dept of Radio Science and Engineering
anne.lahteenmaki@aalto.fi

Anne Medling
Australian National University
anne.medling@anu.edu.au

Anuar Khan Ali Franco
Instituto de FÌsica de Cantabria (IFCA)
anuarkhan@ifca.unican.es

Aycha Tammour
Western University
atammour@uwo.ca

Benny Trakhtenbrot
ETH Zurich
benny.trakhtenbrot@phys.ethz.ch

Bhaskar Agarwal
Yale University
bhaskar.agarwal@yale.edu

Brigitte Rocca-Volmerange
Institut Astrophysique de Paris
rocca@iap.fr

Caitlin Casey
University of Texas at Austin
cmcasey@astro.as.utexas.edu

Camilo Fontecilla
PUC
cjfontec@uc.cl

Carla Elizabeth Fuentes Muñoz
Universidad de Concepción
carlafuentes@udec.cl

Carolin Villforth
University of St Andrews
cv21@st-andrews.ac.uk

Carolina Finlez
Universidad de Concepción
cfinlez@gmail.com

Chelsea E. Sharon
Cornell University
csharon@astro.cornell.edu

Claudio Ricci
Pontificia Universidad Católica de Chile
ricci@kusastro.kyoto-u.ac.jp

Cristina Garcia
PUC - MPIA
cjgarci1@uc.cl

Cristina Ramos Almeida
Instituto de Astrofisica de Canarias
cra@iac.es

Dale Kocevski
Colby College
dale.kocevski@colby.edu

Damien HutsemÈkers
University of LiËge
hutsemekers@astro.ulg.ac.be

Daniel Angles-Alcazar
CIERA - Northwestern University
anglesd@northwestern.edu

Daniel Ruschel Dutra
Universidade Federal do Rio Grande do Sul
daniel.ruschel@ufrgs.br

Daren Croton

Daria Guidetti
Istituto di Radioastronomia INAF
guidetti@ira.inaf.it

Darshan Mahesh Kakkad
European Southern Observatory
dkakkad@eso.org

David B. Sanders
University of Hawaii
sanders@ifa.hawaii.edu

David Rosario
Max Planck Institute for Extraterrestrial Physics
rosario@mpe.mpg.de

David Rupke
Rhodes College
drupke@gmail.com

Davide Fiacconi
Institute for Computational Science, University of Zurich
fiacconi@physik.uzh.ch

Diego Calderón Espinoza
Pontificia Universidad CatÛlica de Chile
dncalderon@uc.cl

Dieter Lutz
MPE
lutz@mpe.mpg.de

Dinalva A. Sales
Universidade Federal do Rio Grande do Sul
dinalvaires@gmail.com

Dominik Riechers
Cornell University
riechers@cornell.edu

Dominik Schleicher
Universidad de Concepción
dschleic@astro.physik.uni-goettingen.de

Edo Ibar
Universidad de Valparaiso
eduardo.ibar@uv.cl

Elena Murchikova
Caltech
murchikova@caltech.edu

Elias Koulouridis
IAASARS, National Observatory of Athens
ekoulour@noa.gr

Emanuele Daddi

Emilia Jarvela
Aalto University Metsahovi Radio Observatory and Dept. of

Everton L¸dke
Universidade Federal de Santa Maria

Radio Science and Engineering
emilia.jarvela@aalto.fi

evertonludke@gmail.com

Ezequiel Treister

Fabio Vito
UNIBO-DIFA, INAF-OABo
fabio.vito@unibo.it

Felipe Garrido Goicovic
Instituto de Astrofisica, PUC
fagarri1@uc.cl

Felix Mirabel
IAFE-Argentina & CEA-France
felix.mirabel@cea.fr

Fernando J. Romero-Cruz
Departamento de Astronomía, Universidad de Guanajuato
fromero@astro.ugto.mx

Fiona Harrison

Flora Stanley
Durham University
flora.stanley@durham.ac.uk

Francesca Civano

Franz Bauer
PUC-Chile
fbauer@astro.puc.cl

Gabriela Canalizo
University of California Riverside
gabriela.canalizo@ucr.edu

George B Lansbury
Durham University
g.b.lansbury@durham.ac.uk

George Privon
Universidad de Concepción
gprivon@astro-udec.cl

Giorgio Lanzuisi
INAF OA-Bologna
giorgio.lanzuisi@oabo.inaf.it

Guilherme dos Santos Couto
Universidade Federal do Rio Grande do Sul (UFRGS)
gcouto@if.ufrgs.br

Gustavo Adolfo Orellana Gonzalez
Universidad de Concepcion
gorellana@udec.cl

Hai Fu
University of Iowa
hai-fu@uiowa.edu

Hsin-Yi Shih
Gemini Observatory - North
jshih@gemini.edu

Hyun-Jin Bae
Yonsei University
hjbae.astro@gmail.com

Ingyin Zaw
New York University Abu Dhabi
ingyin.zaw@nyu.edu

Ioannis Georgantopoulos
National Observatory of Athens
ig@noa.gr

Isabelle Gavignaud
Universidad Andres Bello
igavignaud@unab.cl

Ivan Delvecchio
(1) University of Zagreb, Physics Department, (2) University of Bologna, Department of Physics and Astronomy
ivand@phy.hr

James Aird
Institute of Astronomy, University of Cambridge
jaird@ast.cam.ac.uk

James Mullaney

Jared Gabor
CEA Saclay
jgabor.astro@gmail.com

Jay Blanchard
Universidad de Concepción
jayb@astro-udec.cl

Jeffrey Kenney
yale university
jeff.kenney@yale.edu

Jessie Runnoe
The Pennsylvania State University
runnoejc@psu.edu

Jeyhan Kartaltepe
NOAO
jeyhan@noao.edu

Jillian Bellovary
Vanderbilt University
jillian.bellovary@vanderbilt.edu

Joao Evangelista Steiner
IAG-USP
joao.steiner@iag.usp.br

Joaquin Prieto Brito
DAS U. de Chile
joaquin.prieto.brito@gmail.com

Johannes Buchner
Max-Planck-Institut f¸r extraterrestrische Physik
johannes.buchner.acad@gmx.com

Jong-Hak Woo
Seoul National University
woo@astro.snu.ac.kr

Jorge Cuadra
PUC
jcuadra@astro.puc.cl

Jorge Díaz Tello
Universidad AutÛnoma de México
jadiazt@astrosen.unam.mx

Jorge Melnick
ESO and Observatorio Nacional, Rio de Janeiro
jmelnick@eso.org

Jose Hernandez-Jimenez
Instituto de Fisica- Universidade Federal Rio Grande do Sul
hernandez.jimenez@ufrgs.br

Jose Utreras
Universidad de Chile
jutreras@das.uchile.cl

Juan Andres Molina Tobar
Universidad de Chile
jumolina@das.uchile.cl

Julian Mejia
Universidad de Chile
julianmejia@gmail.com

Julie Comerford

Katherine Alatalo
IPAC/Caltech
kalatalo@caltech.edu

Kevin Schawinski
ETH Zurich
kevin.schawinski@phys.ethz.ch

Kristen M Jones
University of Virginia
kmj5ea@virginia.edu

Kyle D Hiner
Universidad de Concepción
kylehiner@gmail.com

Kyle Willett
University of Minnesota
willett@physics.umn.edu

Lauranne Lanz
IPAC/Caltech
lauranne.lanz@gmail.com

Lia Federica Sartori
ETH Zurich
lia.sartori@phys.ethz.ch

Lisa K. Bachmann
Universit‰ts-Sternwarte M¸nchen
bachmann@usm.lmu.de

Lisa Kewley

Lorena Hern·ndez García
Instituto de AstrofÌsica de Andalucía (IAA-CSIC)
lorena@iaa.es

Luciano del Valle
Departamento de Astronomía, Universidad de Chile

Luigi Spinoglio
IAPS-INAF

ldelvalleb@gmail.com

luigi.spinoglio@iaps.inaf.it

Manuel Aravena
Universidad Diego Portales
manuel.aravenaa@mail.udp.cl

Mar Mezcua
Harvad-Smithsonian Center for Astrophysics
mar.mezcua@cfa.harvard.edu

Mara Salvato
MPE
mara@mpe.mpg.de

Marcella Brusa
DIFA - Universita' di Bologna
marcella.brusa3@unibo.it

Mariana Lazarova
University of Nebraska-Kearney
lazarovam2@unk.edu

Marie Wingyee Lau
University of California, Santa Cruz
lwymarie@ucolick.org

Marios Karouzos
Seoul National University
mkarouzos@gmail.com

Marko Stalevski
Universidad de Chile
mstalevski@das.uchile.cl

Masatoshi Imanishi
Subaru Telescope
masa.imanishi@nao.ac.jp

Massimo Dotti

Meg Urry
Yale University
meg.urry@yale.edu

Menci Nicola
INAF - Osservatorio Astronomico di Roma
menci@oa-roma.inaf.it

Mike Eracleous

Mike Koss

Mischa Schirmer
Gemini South
mschirme@gemini.edu

Mojegan Azadi
UC San Diego, Center for Astrophysics&Space Sciences
mazadi@physics.ucsd.edu

Mónica Silvia Taormina
Universidad de Concepción
mtaormina@astro-udec.cl

Neil Nagar
Universidad de Concepción
nagar@astro-udec.cl

Neven Caplar
Institute for Astronomy, ETH Zurich
neven.caplar@phys.ethz.ch

Nick Scoville
caltech
nzs@astro.caltech.edu

Nicola Menci
INAF-Osservatorio Astronomico di Roma
menci@oa-roma.inaf.it

Oli Luiz Dors Junior
Universidade do Vale do Paraiba
olidors@univap.br

Olimpia Judit Fogasy
Chalmers University of Technology, Department of Earth and Space Sciences
fogasy@chalmers.se

Omaira Gonzalez Martin
Centro de Radioastronomia y AstrofÌsica (UNAM)
o.gonzalez@crya.unam.mx

Orianne ROOS
CEA-Saclay
orianne.roos@cea.fr

Orlando Patricio Vasquez Neira
Univeridad de Concepcion
orlandovasquez@udec.com

Patricia Arevalo
U. de Valparaíso
arevalo.patricia@gmail.com

Patricia B. Tissera
Universidad Andres Bello
patricia.tissera@unab.cl

Patricia Bessiere
University of Sheffield
p.s.bessiere@sheffield.ac.uk

Patricia da Silva
Instituto de Astronomia, GeofÌsica e CiÍncias AtmosfÈricas (IAG-USP)
p.silva2201@gmail.com

Paul Torrey
MIT / Caltech
ptorrey@mit.edu

Paula Andrea Sanchez Saez
Universidad de Chile
psanchez@das.uchile.cl

Paula Calderón Castillo
Universidad de Concepción
Pcalderon@astro-udec.cl

Pawel Biernacki
Institute for Computational Science, University of Zurich
biernack@physik.uzh.ch

Priya Natarajan

Rachel Somerville

Rainer Weinberger
Heidelberg Institute for Theoretical Studies (HITS)
Rainer.Weinberger@h-its.org

Rebecca Davies
Australian National University
Rebecca.Davies@anu.edu.au

Remco van den Bosch

Ricarda Beckmann
University of Oxford
ricarda.beckmann@astro.ox.ac.uk

Ricardo Demarco
Universidad de Concepcion
rdemarco@astro-udec.cl

Roberto Bertoldo Menezes
Instituto de Astronomia, Geofísica e Ciencias Atmosféricas - Universidade de Sao Paulo
robertobm@astro.iag.usp.br

Rogemar A. Riffel
Universidade Federal de Santa Maria
rogemar@ufsm.br

Ronald L‰sker
MPIA
laesker@mpia.de

Rosalie McGurk
University of California Santa Cruz
rmcgurk@ucsc.edu

Roy Lawrence Slater Clement
university of concepcion
royslater@udec.cl

Ryan Brennan
Rutgers University
brennan@physics.rutgers.edu

Sabrina Lyn Cales
Yale University, Universidad de Concepcion
sabrina.cales@yale.edu

Salvatore Cielo
Max Planck Institute for Astronomy
cielo@mpia.de

Sam Kim
Pontificia Universidad Catolica de Chile
skim@astro.puc.cl

Silvia Bonoli
CEFCA
sb.bonoli@gmail.com

Sofía Carolina Gallego Gallego
Pontificia Universidad Católica de Chile
nefinia@gmail.com

Srikar Srinath
University of California Santa Cruz
ssrinath@ucsc.edu

Stephanie Dˆrschner
Institut f¸r Astrophysik, Georg-August Universit‰t Gˆttingen
doerschner@astro.physik.uni-goettingen.de

Stephanie Juneau
CEA-Saclay
stephanie.juneau@cea.fr

Stephanie LaMassa
Yale University
stephanie.lamassa@yale.edu

Sylvain Veilleux

Tanio Diaz-Santos
Universidad Diego Portales
tanio.diaz@mail.udp.cl

Thales Gutcke
Max Planck Institute for Astronomy
thales@mpia.de

Tiago Vecchi Ricci
IAG - University of Sao Paulo
tvricci@iag.usp.br

Tonima Tasnim Ananna
Yale University
tonimatasnim.ananna@yale.edu

Valentina Constanza Ignacia Peirano Bastías
Universidad de Concepción
vale.peiranob@gmail.com

Valeria Olivares Sepúlveda
Universidad de Concepción
volivares@udec.cl

Vernesa Smolcic

Vincenzo Mainieri
ESO
vmainier@eso.org

Vivian U
University of California, Riverside
vivianu@ucr.edu

William Keel

Xian Chen
Instituto de Astrofisica, PUC
chenxianpku@gmail.com

Yoshiki Toba
Ehime University
toba@cosmos.phys.sci.ehime-u.ac.jp

Yun-Kyeong Sheen
Universidad de Concepción
yksheen@astro-udec.cl

TALKS ABSTRACTS

(in order of presentation)

Monday, January 9th

1.1 The Formation of the First Black Holes in the Universe

Priya Natarajan (Yale)

The discovery of ever-massive black holes powering high redshift quasars suggests that their seed black holes likely assembled very early and were more likely massive to start with. Formation scenarios for the first black holes will be reviewed with the potential observational signatures that might help discriminate between various seed models.

1.2 AGN-Host Galaxy Connection: An Interstellar Medium Perspective

Dominik Riechers (Cornell University)

I will discuss recent progress in observations of the neutral/ionized and molecular gas properties of the host galaxies of high-redshift active galactic nuclei, and what we can learn from them about galaxy evolution.

1.3 Black hole formation in the early Universe

Dominik Schleicher (Universidad de Concepción)

While supermassive black holes with more than one billion solar masses have been observed at z>6, it remains a challenge to explain their origin in structure formation models. Here, I present adaptive mesh refinement simulations following the formation of the first massive black holes from cosmological scales down to scales of 1 astronomical unit. I will quantify the expected mass scale of the first massive black holes and discuss the role of chemistry, turbulence and magnetic fields during their formation process, particularly emphasizing on the role of radiative backgrounds.

1.4 Star & Galaxy Formation Induced by Black Hole Jets

Felix Mirabel (IAFE-Argentina & CEA-France)

I will review the évidences for Jet induced star/Galaxy formation. Then I will present the first clear case of massive star formation in the Milky Way induced by microquasar jets, which is the best laboratory to understand the physics of this mechanism of stellar and gamaxy formation during the reionization epoch of the universe.

1.5 Growing black holes: from the first seeds to active galactic nuclei

Mar Mezcua (Harvad-Smithsonian Center for Astrophysics)

Supermassive black holes of up to 10^9 solar masses already existed when the Universe was less than

~1 Gyr old. To reach this mass in such a short time, they should have started as seed intermediate-mass black holes (IMBHs) of 100-10^6 solar masses and grow very fast via accretion and mergers. Such IMBHs are the missing link between stellar and supermassive black holes and they should be present in the nucleus of low-mass galaxies and in the halos of large galaxies, e.g. in the form of ultraluminous X-ray sources (ULXs). Nevertheless, observational evidence of their existence is still scarce.
To probe the existence of the initial seed IMBHs from which supermassive black holes grow, we studied jet radio emission in ULXs. The observations reveal two potential IMBH candidates, one of them in the nucleus of a dwarf galaxy, as well as the detection of the largest non-nuclear extragalactic jet ever discovered. Its location in the arm of a spiral galaxy likely undergoing a minor merger indicates that the nuclei of minor mergers remain amongst the best candidates for IMBHs. We thus carried out a photometric study of double-nucleus disk galaxies candidates to minor mergers. We find that active galactic nuclei (AGN) activity can be triggered by mergers, as expected from simulations, and define one of the largest samples of binary AGN candidates with physical separations below 1 kpc.

2.1 Do MBH binaries coalesce?

Massimo Dotti (Università degli Studi di Milano-Bicocca, Italy)

The theoretical effort towards obtaining a coherent physical picture of the path of MBH binaries down to coalescence is still underway. For the first time we took advantage of observational studies of active galactic nuclei evolution to constrain the efficiency of gas-driven binary decay. Under conservative assumptions we find that gas accretion toward the nuclear black holes can efficiently lead binaries of any mass forming at high redshift (> 2) to coalescence within the current time. The observed "downsizing" trend of the accreting black hole luminosity function further implies that the gas inflow is sufficient to drive light black holes down to coalescence, even if they bind in binaries at lower redshifts (down to z~0.2 for binaries of ~1 million solar masses).

2.2 Formation of supermassive black holes in high-redshift galaxy major mergers

Davide Fiacconi (University of Zurich, Switzerland)

The formation of supermassive black hole (SMBH) seeds is still far from being understood and represents a major challenge in theoretical astrophysics. We use high-resolution, SPH simulations with realistic prescriptions for gas cooling, star formation and stellar feedback to probe the possibility that SMBH seeds form at the centre of high-redshift, major-merger remnants of gas-rich, massive disc galaxies.
We find that the merger is able to sustain a massive inflow of ~10^4 Msol/yr toward the centre for a few 10^4 yr, avoiding widespread fragmentation. The inflow eventually piles up a massive, disk-like, bar-unstable core with up to 10^9 Msol. This massive core is roughly an order of magnitude far from the conditions for the onset of general relativistic radial instability that would lead to the collapse of almost the whole structure. This suggests the intriguing, though speculative, possibility that a SMBH with a mass ~10^8 Msol can form directly in high-z major mergers of massive galaxies, possibly explaining the early occurrence of very massive BHs powering z~6-7 AGN.

2.3 Simulating the history of the Milky Way black hole

Silvia Bonoli (CEFCA)

I will present the results of a new zoom-in hydrodynamical simulation which follows the cosmological evolution and feedback effects of a supermassive black hole at the center of a MilkyWay-type halo.
The simulation, dubbed ErisBH, is the twin simulation of Eris (Guedes et al. 2011), with which it shares the same initial conditions, resolution (120 pc) and physical simulated processes, but it includes also prescriptions for the growth and feedback of massive black holes. The main galaxy in the Eris simulation, which does not suffer major mergers after z=3, features at z=0 the main properties of a late-type spiral and resembles in many aspects our own Galaxy.
In the new simulation ErisBH we explore the possible origin of the black hole of the Galaxy and how its feedback shapes the properties of the host. We find that the galaxy's central black hole grows mainly through mergers with other black holes coming from merging satellite galaxies. The growth by gas accretion is minimal and consequently the feedback on the host galaxy is not dramatic, and only influences the very center of the galaxy. The final black hole is about 2 million solar masses and, in the MBH-sigma plane, it sits closely to the location of the Milky Way black hole.

2.4 Massive Black Hole Binaries Within Sub-parsec Gaseous Discs

Jorge Cuadra (PUC)

Super-massive black hole binaries form after major galaxy mergers, which often involve large amounts of gas flowing to the centre of the new system. Here we present numerical models of binary black holes surrounded by a massive gaseous disc, and show how their interaction shrinks the binary orbit, while at the same time increases its eccentricity and produces a variable accretion rate. We will show that, in the case that the disc fragments and form stars, a relatively large number of the newly-formed stars will be tidally disrupted, producing peculiar reverberation mapping signatures.

2.5 Super massive black holes binaries in star forming massive nuclear discs

Luciano del Valle (Departamento de Astronomía, Universidad de Chile)

We study the evolution of the separation of a pair of SMBH embedded in a star forming massive nuclear disk (MND). This type of disk is expected to be formed in the central kilo parsec of the remnant of gas-rich galaxy mergers. Using N-body/SPH simulations, we test if the migration timescale of the SMBH pair, change for different values of the star formation rate. In our simulations the orbits of the SMBHs are erratically perturbed by the gravitational interaction with high density gas clumps, that are the result of the fragmentation of the MND. We found that, with higher star formation rate, the number of these gas clumps is smaller and the migration timescale of the SMBH pair is shorter. However, we found that the migration timescale only change in a factor 2.2 for a variation of two order of magnitude of the star formation rate.
We compare the density of the gas clumps in our simulations with observations and we found that they are unrealistically high. Therefore, in our simulations the gravitational influence of the gas clumps, in the orbit of the SMBHs, is overestimated.
Besides all the details on the orbital evolution of the SMBH pair, and even considering the overestimation of the clump-SMBH interaction, we found that the migration timescale in our simulations is at most a factor three longer than the migration timescale in simulations without star formation.

3.1 Now you see it, now you don't - the rapid cycle of black hole accretion phases

Kevin Schawinski (ETH Zurich)

We know from the Soltan argument that black holes grow predominantly by accretion. From demographic arguments, we can infer that the total growth time of massive black holes range from 1e7 to 1e9 years. However, we have few constraints on how sustained these growth phases are: do black holes grow in one long phase, or many short ones? I present new evidence that black hole accretion phases are indeed short - on the order of 1e5 years - and discuss implications for black hole growth and AGN feedback. The analogy of X-ray binaries to black holes, while not perfect, may hold clues to how the galaxy-black hole connection actually works.

3.2 TBD

Remco van den Bosch

3.3 Probing the M-sigma relation of active galaxies: present and past

Jong-Hak Woo (Seoul National University)

The M-sigma relation suggests a close connection between black hole growth and galaxy evolution, motivating a flood of theoretical and observational studies over the last decade. Since beyond the local universe, black hole mass can be estimated only for AGNs, it is of importance to calibrate the M-sigma relation for AGN sample. First, we discuss the local M-sigma relation of quiescent and active galaxies, based on the spatially-resolved stellar velocity dispersion (SVD) measurements from Subaru and Keck, in order to understand the effect of the rotational broadening and inclination effect on the measured SVDs. Based on the new measurements, we find no strong evidence that pseudo-bulge galaxies significantly offset from the M-sigma relation, and that local quiescent and active galaxies have a consistent M-sigma relation. Second, we investigate a decade-long debate whether the narrow-line Seyfert 1 (NLS1) galaxies offset from the M-sigma relation, using directly measured SVDs. We find no strong evidence that the NLS1s deviates from the M-sigma relation of the reverberation-mapped broad-line AGNs. However, we find a clear trend of the offset with the host galaxy morphology, i.e., more inclined galaxies toward the line-of-sight have higher stellar velocity dispersion, suggesting that the rotational broadening plays a role in measuring stellar velocity dispersion when spatially resolved measurements are not available. Third, we present the updates and summary of our series of investigation on cosmic evolution of the scaling relations out to look-back times of 4-6 Gyrs (with 52 objects) and 8-10 Gyrs (with 27 objects), using Keck spectra and HST images. Comparing the high-z AGNs with local AGNs and taking into account selection effects, we find evolution of both M-L_bluge and M-sigma relations, suggesting that BH growth precedes the final assembly of bulges.

3.4 New Evidence for High Spins Among the Most Massive Black Holes at z~2-4

Benny Trakhtenbrot (ETH Zurich)

The spins of growing super-massive black holes (a*) dictate the radiative effciencies of the accretion process, and hold evidence regarding their past growth. This is particularly relevant for the most massive BHs observed at high redshifts, which must grow effciently in order to match BH seeding scenarios. Theoretical models broadly predict that the most massive BHs may either "spin-down" to a*~0 or alternatively "spin-up" to the maximal allowed value, a*~1. Our current ability to

observationally test the relevance of these two scenarios at high redshifts is, however, highly limited.
I will present new constraints on the radiative effciencies (and therefore, BH spins) of a large sample of luminous un-obscured AGN at z~2-4, powered by some of the most massive black holes known. The analysis relies on estimates of BH masses, bolometric luminosities and accretion rates, based on the virial approach and on simple scaling laws emerging from accretion disk models.
Most of the extremely massive BHs in the sample (i.e., M_BH > 3x10^9 M_sun) show very high BH spins, with typical values well above a~0.7. This strongly supports a "spin-up" scenario, which is driven by either prolonged accretion or a series of anisotropically oriented accretion episodes. Since the high masses of such extreme BHs require effcient growth, it is argued that the most probable scenario is that of an almost continuous sequence of randomly, yet not isotropically oriented accretion episodes.
I will also discuss the potential to constrain the spins of SMBHs at yet higher redshifts, and possible implications for the (in-)completeness of high-redshift AGN surveys.

3.5 Merger Remnants and Aging Starbursts in Quasar Host Galaxies

Gabriela Canalizo (University of California Riverside)

Although mergers and starbursts are often invoked in the discussion of quasar activity and its effect on galaxy evolution, several studies have questioned their importance or even their presence in quasar host galaxies. Accordingly, we are conducting a study of low-redshift quasar host galaxies previously classified as passively evolving elliptical galaxies. In this talk, I will discuss Keck LRIS spectroscopy and HST imaging of this sample that clearly shows that these galaxies have undergone major episodes of star formation in the past 2 Gyr. The morphologies of the host galaxies suggest that these aging starbursts were induced during the early stages of the mergers that resulted in the elliptical-shaped galaxies that we observe. The current AGN activity likely corresponds to the late episodes of accretion predicted by numerical simulations, which occur near the end of the mergers, whereas earlier episodes may be more difficult to observe due to obscuration. I will discuss numerical simulations that indicate that any potential current star formation or young stellar populations in these galaxies would be confined to the central few kiloparsecs, a region that is typically outshined by the bright nucleus.

Tuesday, January 10th

4.1 Modeling AGN and AGN feedback in a cosmological framework

Rachel Somerville (Rutgers University, USA)

Modeling the growth of supermassive black holes and their impact on galaxies and their surroundings is one of the greatest challenges in modern theoretical astrophysics, owing to the vast range of scales and the diversity of physical processes at play. I will review the state-of-the-art in numerical hydrodynamical and semi-analytic cosmological simulations of the co-evolution of supermassive black holes and galaxies, and discuss successes of the current paradigm, open puzzles, and areas for future improvement.

4.2 From halo quenching to radio jets in semi-analytic galaxy formation models

Darren Croton (Swinburne University of Technology, Australia)

In this talk I will discuss methods used to include the effects of AGN feedback in galaxy formation

models. In particular, i'll focus on the modelling of radio jets and bubbles, and consider plausible ways to produce observables that can be compared against current and upcoming observations. Such models need to be well motivated and believable if they are to be used to interpret the next generation of multi-wavelength survey data.

4.3

Nicola Menci (INAF - Osservatorio Astronomico di Roma)

Using the Rome semi analytic model for galaxy formation, we have investigated the effects of assuming two different mechanisms for triggering AGN activity on the properties of AGN host galaxies: i) disk instabilities (DI) in isolated galaxies, and ii) galaxy interactions (IT), adopting a physical modeling for the accretion flow in DI. We obtained the following results: i) both the DI and IT modes are able to account for the observed abundance of AGN host galaxies with $M_* <10^{11} M_sun; for more massive hosts, on the contrary, the abundance in the DI scenario is well below the observational estimates up to $z=4$. ii) DIs are expected to yield AGN hosts with bluer colors, while in the IT scenario the majority of hosts are expected to reside in the red sequence. iii) While both IT and DI scenarios can account for AGN triggered in main sequence or starburst galaxies, DIs fail in triggering AGN activity in passive galaxies; iv) The two modes are characterized by a different duration of the AGN phase, with DIs lasting even on time scales ~ Gyr, while for IT case where the duration is ~ 10^7 - 10^8 yr. v) The scatter of the SFR-L_{bol} relation is appreciably lower for the DI case (especially at low-intermediate AGN luminosities). vi) Disk instabilities are not able to account for the observed fraction of AGN in groups for z < 1 and clusters for z < 0.7, while the IT scenario provides a good match to observational data.

4.4 Can Compact Starbursts Mimic Quasar-Mode Feedback?

Aleksandar M. Diamond-Stanic (University of Wisconsin)

Cosmological simulations and semi-analytic models require strong AGN feedback (both ejective and preventive) in halos more massive then 10^12 Msun to match the observed stellar mass function. However, the prescriptions for quasar-mode and radio-mode feedback are tuned to get match this global constraint, and it is not clear that they tell the full story of how massive galaxies shut down their star formation. A defining characteristic of quiescent galaxies is their high stellar densities, implying that they formed stars at high densities before quenching. To provide observational constraints on feedback at high densities, we (Diamond-Stanic+2012, Geach+2013, Sell+2014, Geach+2014) have been studying a sample of galaxies with the largest outflow velocities (~1000-2000 km/s) and the largest SFR surface densities (~1000 Msun/yr/kpc^2) among star-forming galaxies at any redshift. This includes our recent result that radiation feedback from massive stars can drive nearly 10^9 Msun of molecular gas to 10 kpc at 1000 km/s (Geach+2014). The compact sizes of these galaxies (and the r^-0.5 velocity scaling of SF-driven outflows) suggest that the outflowing gas has been accelerated from r~100 pc to >kpc scales by the ejective feedback associated with star formation. There is certainly evidence for AGN activity in the sample, but at a level that is sub-dominant bolometrically, suggesting that black hole growth is associated with the small fraction of low-angular-momentum gas that is not consumed or expelled by the nuclear starburst. I will discuss these observational results in the context of theoretical models for star formation, black hole growth, and feedback.

4.5 Stellar and Quasar Feedback in Concert: Effects on AGN Accretion, Obscuration, and Outflows

Paul Torrey (MIT / Caltech)

I will present hydrodynamic simulations investigating the interaction of active galactic nucleus (AGN) feedback mechanisms with a multi-phase interstellar medium (ISM). Our employed ISM model includes radiative gas cooling and explicit stellar feedback from multiple processes, which allows a clumpy ISM structure to develop. Our employed AGN feedback model focuses on fast accretion disk winds and gas Compton heating off the AGN radiation. We simulate the central 100 pc of a galactic nuclear disk with ~ 0.1 pc force resolution, allowing us to resolve the scales where AGN-powered winds and radiation first couple to the ISM. We find AGN winds injected at small radii with momentum fluxes $\sim L_{\rm AGN}/c$ couple efficiently to the ISM and significantly redistribute gas in the central ~ 100 pc. AGN winds suppress the nuclear star formation rate by a factor of $\sim 10-30$ and the black hole accretion rate by a factor of $\sim 3-30$. They increase the total outflow rate from the galactic nucleus by a factor of ~ 10. The latter is broadly consistent with observational evidence for galaxy-scale atomic and molecular outflows driven by AGN rather than star formation. In simulations that include AGN feedback, the predicted column density distribution towards the black hole is reasonably consistent with observations, whereas absent AGN feedback, the black hole is isotropically obscured and there are not enough optically-thin sight lines to explain observed Type I AGN. A 'torus-like' geometry arises self-consistently because AGN feedback evacuates the polar region of gas.

5.1 TBD

Fiona Harrison (Caltech)

5.2 Unveiling the AGN/galaxy evolution connection with deep extragalactic far-IR surveys

David Rosario (Max Planck Institute for Extraterrestrial Physics)

The far-infrared Herschel Space Observatory has opened our eyes to the cold dusty distant Universe. I will report on studies that bring together the very best modern multi-wavelength survey datasets, from the X-rays to the optical to the far-IR, aimed towards developing a coherent view of the growth of supermassive black holes (in AGN) and the growth of stellar content in galaxies (through star-formation). I will demonstrate that a positive relationship between star-formation and AGN activity is now clearly seen to $z > 2$. However, the nature of this relationship supports unsynchronised or stochastic co-evolution, driven more by the smooth increase in gas content in normal galaxies over time rather than a dominant role of short, intense episodes, such as star-bursts or mergers. This has implications for our understanding of luminous AGN duty cycles and the evolution in the accretion rate density of black holes over time.

5.3 IR spectroscopy as diagnostics of galaxy evolution

Luigi Spinoglio (IAPS-INAF)

Mid- to far-IR spectroscopy gives us one of the best tools to study the physical processes in dust enshrouded galaxies along evolution. The peak of both the star formation and black hole accretion at redshifts z=1-3 can be studied in detail though ionic fine structure lines. Molecular lines will trace outflowing and in falling motions. Starting from the results of Spitzer and Herschel spectroscopy, the potential of an IR space telescope such as SPICA to perform the first physical study of galaxy evolution in the IR will be outlined.

5.4 How is the host galaxy at mid-infrared when the AGN torus disappears at low-luminosities?

Omaira Gonzalez Martin (Centro de Radioastronomia y Astrofísica (UNAM))

Low-luminosity active galactic nuclei (LLAGN) are key to understand the connection (perhaps evolutive) between normal and active galaxies. We have recently found that there are also key to study the connection between the AGN and its host. AGN at mid-infrared are dominated by the clumpy torus emission. However, this torus is expected to disappear below the bolometric luminosity of Lbol=10E+42 erg/s. We have analysed the obscuration of 45 LLAGN (with bolometric luminosities 10E+38 — 10E+43 erg/s) using Spitzer/IRS spectra. We have found for the first time that the torus signatures disappear below the predicted bolometric luminosity. Below that limit, the mid-infrared spectra of LLAGN seem to be a combination of an elliptical galaxy, planetary nebulae, and/or jet emission. This host galaxy environment is probably always similar, although only reachable when the torus emission is not longer the dominant source of emission at mid-infrared.

5.5 Scale relations from submm observations

Gustavo Orellana (Universidad de Concepcion)

In order to understand the different observed star formation modes that galaxies show. We use a large sample (~780) of nearby (z<0.2) galaxies, which has non interferometric CO (J=1-0), infrared (IRAS, Spitzer) and sub-milimetric (Planck, SCUBA) observations. We study how the masses of dust, atomic and molecular gas are related to star formation rates, following the specific star formation rate (sSFR=SFR/Mstar) mode paradigm. We find that galaxies classified by sSFR share properties, such as dust to stellar mass ratio, dust temperature, among others. Finally, we find these galaxies follow a relation on the L_IR-Md-Td fundamental plane.

6.1 NuSTAR and ALMA's view of BH growth and star-formation

James Mullaney (University of Sheffield)

The past 3 years have witnessed the birth of two important new facilities for our study of the links between BH growth and star-formation: NuSTAR and ALMA. In this talk, I will present results from both: the first results from the NuSTAR-ECDFS survey - the deepest contiguous component NuSTAR's extragalactic survey program - and ALMA's survey of high redshift AGN in the CDFS. While the former is providing key insights into the properties of obscured BH growth, the latter is offering important new clues as to how the relationship between BH growth and galaxy growth has evolved over cosmic time.

6.2 Heavily-obscured black hole accretion in star-forming galaxies at z~2

Agnese Del Moro (Durham University)

Understanding the connection between supermassive black holes (SMBH) and host galaxies requires exploring SMBH accretion and star-formation processes at each phase of their cosmic coevolution, especially at high redshift, at the peak of their activity. However, this is not trivial as most of the SMBH growth seems to occur in heavily-obscured systems, which are difficult to identify even in the deepest X-ray surveys.
With detailed Spectral Energy Distribution decomposition using deep Spitzer and Herschel infrared (IR) data in the GOODS-North and GOODS-South fields, we identified a sample of mid-IR bright quasars (nu L(6 micron)>6x10^44 erg/s) in star-forming galaxies at redshift z=1-3. Despite being intrinsically the brightest quasars in these fields ~30% are not detected in the extremely-deep 2 Ms and 4 Ms Chandra X-ray data. These sources are candidates to be the most heavily-obscured, Compton-thick (CT) quasars. From X-ray spectral analysis we find that the large majority of the IR quasars (~80%) are obscured by column densities NH>10^22 cm^-2, and we constrain the fraction of CT quasars to be ~40%, a much higher fraction than those previously found in several X-ray and optically selected samples.
Our results support the evolutionary model predictions of a large population of heavily-obscured quasars at z~2, when the SMBHs and host galaxies are undergoing a phase of very active accretion and star formation, embedded in large amounts of dust and gas.

6.3 The evolution of the X-ray luminosity functions of obscured and unobscured AGN: new constraints from Chandra and NuSTAR

James Aird (Institute of Astronomy, University of Cambridge)

Establishing the prominence of both obscured and unobscured growth phases of supermassive black holes is vital to shed light on the processes that trigger and fuel AGN across cosmic time. I will present a new study of the evolution of the X-ray luminosity functions (XLFs) of both obscured and unobscured AGN, combining data from major deep and wide Chandra surveys. We adopt a Bayesian methodology to combine samples selected at both hard (2-7keV) and soft (0.5-2keV) X-ray energies, statistically account for the effects of X-ray absorption, and place constraints on the independent evolution of the XLFs of obscured and unobscured AGN. We find that the evolution of both populations is driven by a combination of strong luminosity evolution (a shift to higher luminosities at higher redshifts) and a strong evolution in the overall normalisation (which peaks at z~1-2). Our model naturally reproduces the luminosity- and redshift-dependence of the obscured fraction of AGN, which is explained by differences in the shapes of their XLFs and their relative evolution. These differences may also explain the observed flattening in the total XLF of AGN at higher redshifts. I will also present preliminary results from the NuSTAR extragalactic surveys programme, which enable the first measurements of the XLF of AGN at very hard X-ray energies (>8keV) outside of the local Universe, providing direct constraints on the overall evolution of unobscured, obscured and Compton-thick AGNs.

6.4 The most obscured AGN in the COSMOS

Giorgio Lanzuisi (INAF OA-Bologna)

I will present the results published in our recent paper (Lanzuisi et al. 2014 arXiv 1409.1867) on the search for Compton Thick AGN in the COSMOS survey.
We exploited the rich multi-wavelength dataset available in this field in order to characterize the host galaxy and SMBH properties of a sample of 40 X-ray selected CT and highly obscured AGN. Do they harbor smaller, rapidly growing SMBH with respect to unobscure AGN? Are they hosted in strongly star-forming, merging and post merger systems? The results obtained for this sample strengthen the scenario in which highly obscured AGN occupy a peculiar place in the galaxy-AGN co-evolution, in which both the host and the SMBH rapidly evolve toward the local relations.

6.5 Obscured accretion with NuSTAR

Patricia Arevalo (Universidad de Valparaíso)

Analyses of the cosmic X-ray background have shown that a large part of the black hole growth in the universe took place behind dense clouds of obscuring material. It is therefore crucial to the study of the development of black holes to derive accurate physical parameters of these obscured accretors. Hard X-rays are capable of penetrating thick layers of material so it is only at these energies where we have a change to look directly into the central engine of these sources. The focusing nature of the NuSTAR telescope is unique at hard X-rays, producing the lowest background-contamination spectra to date, rendering accurate, high signal to noise spectra up to 80 keV. NuSTAR covers precisely the energy range where the main features of obscured accretion appear and where the intrinsic emission might even shine through. Importantly, the low level of background also allows us for the first time to measure rapid variability of AGN at high X-ray energies. Both features combined are revealing the detailed nature of the engine of nearby obscured AGN, including the properties of the obscurer, the intrinsic emitted flux of the AGN and whether or not we can see through the torus at these high energies.

6.6 SINFONI and ALMA observations to test the effect of AGN feedback on the gas content of z~1.5 galaxies.

Vincenzo Mainieri (ESO)

From a mere ornament in the center of the galaxy, the SMBH turned in a potential major actor in shaping the final stellar mass of its host via the so-called AGN feedback. From the observations there is mounting evidence that AGN outflows are ubiquitous, but what is still largely missing are observational proofs of the impact that such AGN-driven outflows have on their hosts. We will report on two projects that we have started to improve our knowledge on this topic: a) we used SINFONI to study the velocity structure of the [OIII]5007
line in a sample of radio-quite quasars at z~1.5. We will discuss the presence of kpc-scale outflows in these objects and their impact on the star-formation of the host galaxy as traced by the narrow Ha emission; b) we are using ALMA band-3 observations to measure molecular gas masses, via the 12CO(2-1) transition line, in a representative sample of 'main-sequence' z~ 1.5 AGNs. We compare the star-formation efficiency and gas fraction of their hosts with those of inactive galaxies in the same range of stellar masses, SFR and redshifts.

Wednesday , January 11th

7.1 Powerful outflows in luminous obscured QSOs

Marcella Brusa (DIFA - Universita' di Bologna)

Quasar feedback on host galaxies in the form of powerful outflows is invoked as a key mechanism to quench star formation in massive galaxies, but direct observational evidences are still scarce and the debate on the physical origin of the observed outflows is still open.
After reviewing the observational constraints we have so far on the existence and origin of this mechanism, I will present new X-shooter@VLT observations of a representative sample X-ray obscured QSOs at z~1.5 from the XMM-COSMOS survey, expected to be caught in the transitioning phase from starburst to AGN dominated systems. We could infer the presence of outflows in 6 out of 8 sources and a comparison of the outflow energetic with the AGN luminosity and the kinetic energy associated to stellar processes, suggest that the AGN rather than the on-going star-formation may be the major driver for the presence of the observed broad and shifted components.
In the two brightest sources we were also able to probe, via slit resolved spectroscopy, that the outflows extend up to 10 kpc scales. Finally, I will present unambiguous evidences of the effect of feedback in the host galaxy of one of these powerful QSOs, based on SINFONI and PdBI data.

7.2 AGN in Infrared Galaxies and the Evolving BPT Diagram

Jeyhan Kartaltepe (NOAO)

Rest-frame optical emission line diagnostics to identify AGN are expected to be redshift-dependent due to the changing ionization state of the interstellar medium of high-redshift galaxies. To confirm this, we establish the presence of AGN in a large sample of U)LIRGs selected as Herschel-PACS and Spitzer-MIPS detections in two redshift bins (z ∼ 0.7 and z ∼ 1.5) using near-infrared spectroscopy from Subaru-FMOS with detections of all four key emission lines. In addition, we construct a low redshift (z ∼0.1) comparison sample of infrared selected galaxies and find that the evolution from z ∼ 1.5 to today is consistent with the theoretical models. We find that a large fraction of (U)LIRGs are BPT-selected AGN using the new, redshift-dependent classification line. We compare the position of known X-ray detected AGN with the BPT selection and find that the new classification line accurately selects most of these objects. Furthermore, we identify new (likely obscured) AGN not selected as such by their X-ray emission.

7.3 The AGN/Star-Formation Connection in the Local Universe

Stephanie LaMassa (Yale University)

We probed the connection between AGN activity and star-formation in a sample of ~28,000 obscured AGN in the contemporary Universe. By constructing matched samples of galaxies over a range of redshifts, we studied this relationship over a range of radial scales, tracing the radial distribution of star-formation as a function of AGN luminosity. We demonstrate that as an AGN becomes more luminous, the star-formation becomes more centrally concentrated, implying that such circumnuclear star-formation (on scales <1.7 kpc) is related to black hole fueling. We parameterize this relationship and find that the star-formation rate has a sub-linear dependence on supermassive black hole accretion.

7.4 The pre- eROSITA era: ROSAT-revisited and SPIDERS

Mara Salvato (MPE)

In view of the future launch of eROSITA, we are looking with new eyes to the ROSAT all-sky survey (RASS). In-fact, the technological advances of the last few years allow us to exploit the old surveys in new ways.
Together with an overview on what eROSITA will bring to AGN-related science, I will present the MPE efforts in updating the RASS Database, and the scientific opportunities that this will offer. I will also present SPIDERS, the spectroscopic survey of ROSAT/eROSITA sources within the SDSS-IV program, which begun in July 2014, together with some preliminary science output from the first months of the survey.

7.5 Optical AGN Diagnostics at z~2

Alison Coil (University of California San Diego)

I will present results from the z~2 Keck/MOSDEF survey on AGN identification and completeness at high redshift using optical versus X-ray selection. I investigate the location of X-ray selected AGN in the BPT, MEx (mass-excitation), and CEx (color-excitation) diagrams and find that while the BPT diagram works very well to identify AGN at high redshift, the MEx and CEx diagrams are not as complete and suffer from contamination from star-forming galaxies. I will further discuss how optical AGN samples selected using the BPT diagram have selection biases and miss AGN in low mass and/or high sSFR galaxies at both low and high redshift. These selection biases become stronger at high redshift, such that optically-selected AGN samples are necessarily incomplete. I will also present results on the metallicities of AGN at z~2.

8.1 The demography of obscured AGN

Andrea Comastri (INAF-Osservatorio Astronomico di Bologna)

According to recent models for the joint growth of Super Massive Black Holes and their Host Galaxies, heavy, possibly Compton thick, obscuration represents a key phase in their evolution and is expected to play a fundamental role in the feedback mechanisms linking SMBH activity with host galaxy properties.
A recent revision of the scaling relations indicate that the local mass density in black holes could be significantly higher (by a factor 2-4) than previously thought. A possible explanation would be in terms of an increased fraction of the deeply buried Compton thick AGN. I will discuss to what extent a population of ultra obscured AGN could be accommodated in the current observational picture without violating the limits imposed by the hard X-ray and mid-infrared backgrounds spectral energy density.
After a review of the key results obtained by deep Chandra and XMM surveys over the last 15 years in the search for and characterization of heavily obscured SMBH; I will discuss the perspectives for future observations with the forthcoming eROSITA and ASTRO-H missions and the future ESA Large mission ATHENA.

8.2 A New Method for Selecting Compton-thick AGN Above 10 keV

Michael Koss (ETH-Zurich, Switzerland)

We present NuSTAR observations of a new sample of heavily obscured AGN identified based on their Swift BAT spectra above 10 keV. We use the Swift all-sky maps with a scheme optimized to detect nearby, heavily obscured AGN based on the spectral curvature. We find that all these nine targets are consistent with Compton-thick AGN and contain some of the nearest examples of reflection-dominated AGN available across the sky. Based off the robustness of the spectral curvature to identify Compton-thick AGN, we find that a much higher fraction of nearby AGN may be Compton-thick than measured in past studies of X-ray selected AGN. Finally, we find tentative evidence that Compton-thick AGN maybe more likely to be associated with close mergers (<10 kpc).

8.3 New constraints on X-ray background synthesis models

Ioannis Georgantopoulos (National Observatory of Athens)

We discuss the new constraints on X-ray background (XRB) synthesis models. The constraints on XRB models arise primarily from the number counts in several X-ray bands ad secondarily from the spectrum of the XRB itself. We compare our XRB model (Akylas et al. 2012) with recent results on the number of Compton-thick objects in the 2-10 keV band by Brightman et al. (2014), the NUSTAR results in the 10-40 keV band as well our own analysis of the 70-month catalog SWIFT/BAT AGN.
We also present a comparison with the XRB synthesis models of Gilli, Treister, Ballantyne and Ueda and we finally discuss with the new constraints that arise on the fraction of heavily obscured AGN.

8.4 Hidden AGN in Star-Forming Galaxies: Triggering or Quenching?

Stephanie Juneau (CEA-Saclay)

By taking advantage of the deepest Spitzer and Herschel observations, we get an unprecedented view of the dusty universe and we can shed some light on the long sought-after connection between galaxies and their central supermassive black hole. Using a sample of far-infrared galaxies at intermediate redshifts, I will show that actively-accreting black holes are especially common in star-forming galaxies, and that a large fraction of black hole growth takes place in an X-ray obscured phase. Multi-wavelength SED-fitting allows us to account for the AGN versus star formation energy budget, and this energetic balance is contrasted with the evolutionary stage of the galaxies on the mass-SFR plane: normally star-forming, starbursting, or quenched. Among other results, this work reveals the need to change conventional views of black hole fueling and obscuration. I will present updated AGN emission-line diagnostic diagrams, adapted to deal with the higher importance of the interplay with host galaxy star formation rates at higher redshifts, and to deal with survey detection limits. The latter is key to account separately for selection effects and true evolution.

8.5 ISM Properties of Cool and Warm Local LIRGs - A Herschel View

Tanio Diaz-Santos (Universidad Diego Portales)

Luminous and Ultra-luminous Infrared Galaxies ((U)LIRGs) represent the most important galaxy population at redshifts $z>1$ as they account for more than 50% of all star formation produced in the Universe at those epochs, constituting what it is called the main-sequence (MS) of star-forming

galaxies. Investigating their local counterparts –low luminosity LIRGs– is therefore key to understand the physical properties and phases of their inter-stellar medium (ISM), which are difficult to study in the distant Universe. On the other hand, high-z star-bursting (out of the MS) systems, although small in number, account for a modest yet still significant fraction of the energy production. Here I present far-IR line emission observations ([CII]158μm, [OI]63μm, [OIII]88μm and [NII]122μm) obtained with Herschel for two large samples of nearby LIRGs: The Great Observatories All-sky LIRG Survey (GOALS), a sample of more than 240 relatively cold LIRGs, and a survey of 30 LIRGs selected to have extreme warm mid- to far-IR colors, indicative of an ongoing intense nuclear starburst and/or an AGN. Using photo-dissociation region (PDR) models we derive the basic characteristics of the ISM (ionization intensity and density) for both samples and study differences between systems as a function of AGN activity, merger stage, dust temperature, and compactness of the starburst – parameters that are thought to control the life cycle of galaxies moving in and out of the MS.

Thursday, January 12th

9.1 The cosmic evolution of star formation and gas in galaxies and the concomitant black hole growth

Emanuele Daddi (CEA, France)

Multi-wavelength observations over the last decade lead to the current paradigm for the stellar mass growth of galaxies in which the distribution of star formation rates and gas in galaxies are highly ordered, with tight correlations observed between key physical parameters like stellar masses, gas masses, star formation rates and efficiencies, etc. Since a few years we also know that a similar behaviour is likely affecting the growth of the central black holes, once short time fluctuations are got rid by ensamble averaging. I will discuss the latest developments of such a picture, including the differentiation of disk like and starburst systems, attempting a constrain on the role of most obscured accreting AGNs through the use of a new highly deblended IR catalog in GOODS-North, and discussing open issues.

9.2 AGN in SMGs: the symbiosis of the Universe's extreme phenomena

Caitlin Casey (University of Texas at Austin)

Submillimeter galaxies (SMGs) are the most extreme star-forming galaxies in the Universe. Similarly luminous AGN represent some of the most extreme energetic sources in the distant Universe. What can the intersection of these two extremes teach us about galaxy evolution at early times? I'll discuss some of the big picture context of why studying AGN in SMGs is very useful for understand the conditions of starbursts, the relationship between starbursts and AGN feedback, ways in which we measure AGN contribution to SMGs, and how the two together can be useful probes for the most overdense environments in the early Universe.

9.3 Probing the early Universe with sub-millimeter observations of extreme quasars

Amy Kimball (CSIRO Astronomy & Space Science)

I will present ALMA observations of some of the most luminous quasars known, investigating their far-infrared emission and discussing an extremely broad and luminous [CII] line in a quasar at redshift

z=4.6. This quasar is one of the most luminous optical quasars known, with a bolometric luminosity greater than 10^14 Lsun (as or more luminous than the most luminous obscured quasars). ALMA continuum observations allow us for the first time to probe the far-infrared properties of this extremely luminous quasar population. The broad [CII] line observed in one source indicates a massive rotating disk around a very massive black hole that was already established at high redshift. In contrast with previously published claims based on [CII] observations of other high-redshift quasars, we show that this source, and previously observed sources, are easily consistent with the locally determined M-sigma relation. This result has strong implications for theories of early growth of black holes in galaxies.

9.4 High-density Molecular Gas Tracers in (U)LIRGs: AGN or Star Formation?

George Privon (Universidad de Concepción)

I will present new IRAM 30m observations of the HCN (1–0) and HCO+ (1–0) emission in a sample of Luminous and Ultraluminous Infrared Galaxies from the Great Observatories All-sky LIRG Survey. These new measurements are compared with mid-infrared AGN diagnostics to ascertain if enhanced HCN emission (relative to HCO+) correlates with increased AGN dominance. I will also compare consider the global relationships of these dense gas tracers with the infrared luminosity, to investigate the relationship between the HCN and HCO+ luminosities and the ongoing star formation. These comparisons suggest the HCN and HCO+ emission depend on both density and radiative effects (XDRs, mid-infrared pumping), obstructing a simple interpretation of the HCN/HCO+ ratio.

9.5 Gas Dynamics in the Dusty Cores of Local Galaxy Mergers

Vivian U (University of California, Riverside)

Gas-rich galaxy mergers provide a means to funnel gas into the central region of the system, consequently fueling nuclear star formation and supermassive black holes. The details of the fueling and feedback are often obscured by the dust stirred up from the galaxy interaction. To probe the small-scale gas kinematics in the inner kiloparsec region of local galaxy mergers requires high-resolution infrared observations of their nuclei. Here I present results from our Keck Adaptive Optics near-Infrared integral-field survey of the nuclear regions in 17 late-stage mergers. Our findings characterized and addressed the nature of nuclear disks, outflows driven by AGN and starbursts, as well as the role of mergers in black hole-galaxy bulge scaling relations. Our observations further enabled several case studies showing direct evidence of biconical molecular outflows as well as shocked gas from outflows and ISM collision between progenitor galaxies.

10.1 AGN and Galaxy Evolution in 3D

Lisa Kewley (ANU, Australia)

10.2 Radio AGN activity over cosmic time

Vernesa Smolcic (University of Zagreb, Croatia)

I will present an overview of the characteristics of radio AGN, based on radio-selected samples at low (SDSS/NVSS and 3CRR surveys; z<0.3) and high redshifts (COSMOS survey, z<5), that for the first

time observationally test the importance of radio-mode feedback in massive galaxy formation (out to z~3). In particular, in the context of the commonly adopted blue-to-red galaxy evolution scenario we find that the two major radio AGN populations -- the powerful high-excitation, and the weak low-excitation radio AGN -- represent two, earlier and later, stages of massive galaxy build-up. To expand this study to higher redshifts, we developed a new method that efficiently selects weak AGN (such as Seyfert, LINER, and absorption line AGN) based only on their NUV-NIR photometry, and we conducted observations of the COSMOS field at 3 GHz (10 cm) with the upgraded VLA, the VLA-COSMOS 3 GHz Large Project, providing to-date simultaneously the largest (2 sq. deg.) and deepest (rms=2.45 uJy/beam) radio continuum survey. I will present the first results based on this survey.

10.3 Galaxy Zoo: disk structures and their relation to the presence of an AGN

Kyle Willett (University of Minnesota)

All-sky surveys with millions of galaxies offer the ability to probe the conditions triggering active black holes as a function of multiple physical parameters. Many of these can be reliably measured automatically (color, size, local density), but accurate and detailed galaxy morphology is still a major challenge for automated algorithms. I present recent work from the Galaxy Zoo project examining the co-existence of AGN (as identified from optical lines) with kpc-scale disk structures in their host galaxies, focusing on the role of strong bars. There is a small increase in the AGN fraction for strongly barred galaxies in the local Universe, but other dynamical mechanisms seem to play a more dominant role in AGN fueling. While bars do exist in disks out to at least z=1.5, Hubble imaging places an upper limit on bar-driven AGN fueling out to at least z=1.0. These results suggest that large-scale bars have not been the dominant mechanism for SMBH growth in massive galaxies.

10.4 J2240-0927: A quasar ionization echo illuminating an outflow remnant?

Rebecca Davies (Australian National University)

AGN ionization echoes are crucial probes of the rate and triggers of AGN variability on timescales of 10,000-100,000 years. The most extreme ionization echoes, `Green Bean' (GB) galaxies (Schirmer et al. 2013), provide insights into the physical mechanisms driving the rapid demise of luminous quasars. In this talk I will present Gemini-GMOS IFU data for the GB system J2240-0927, a disk-like central galaxy with an 8x18 kpc ionized gas cloud lying 12 kpc from the nucleus. I will explore the kinematics, ionization state, temperature and density of the ionized gas across the system, and describe the physical origin of each individual line-emitting component. There is strong evidence for widespread kinematic and morphological disturbance, indicating that J2240-0927 is a post-merger. The ionized gas cloud has a strong kinematic link to the central AGN and is co-rotating with the main body of the galaxy, suggesting that it is the remnant of a quasar-driven outflow. Our analysis of J2240-0927 indicates that GBs provide a unique fossil record of the transformation from luminous quasars to weak AGN. Investigating the evolutionary histories of GBs will allow us to place strong constraints on AGN accretion models and to examine the physical processes driving AGN duty cycles.

10.5 Post Starburst Quasars

Jorge Melnick (ESO and Observatorio Nacional, Rio de Janeiro)

Post Starburst Quasars are a distinct class of AGN characterised by having a strong intermediate-age stellar population and strong emission lines. They may be the progenitors of K+A galaxies that show

no signs of star formation or AGN activity, and that are supposed to be the direct progenitors of elliptical galaxies formed after the merger of two spirals. In this contribution I will present the properties of a large sample of PSQs from the SDSS and compare their properties to those of a similar sample of K+A galaxies in the context of the evolution of mergers in the local universe.

11.1 Evidence for Star Formation and AGN Feedback in the Dust and Molecular Gas of Galaxies

Sylvain Veilleux (University of Maryland, USA)

I will summarize the best recent evidence for star formation and AGN feedback in galaxies, focusing on the dust and molecular components of the ISM, the raw material for the next generation of stars. This review will look at the full galaxy spectrum from dwarf galaxies and mildly star forming galaxies to the most powerful starbursts and AGN in the local universe. I will conclude by discussing some recent results on the mechanism that drives the most extreme molecular outflows.

11.2 Probing the Origin of Supermassive Black Holes with Dwarf Galaxies

Amy Reines (University of Michigan)

Supermassive black holes (BHs) reside in the nuclei of essentially all massive galaxies with bulges, power AGN, and are thought to be important agents in the evolution of their hosts. However, the origin of the first supermassive BH "seeds" in the early Universe is far from understood. I will discuss efforts to search for and study the smallest BHs in present-day dwarf galaxies, which are beginning to provide the much needed observational constraints on the masses, host galaxies, and formation path of supermassive BH seeds.

11.3 Unveiling Quasar-Mode Feedback with Integral Field Spectroscopy

David Rupke (Rhodes College)

Observations of are increasingly pointing to the prevalance of massive, high-speed, wide angle outflows in nearby quasars. A primary technique by which these outflows are detected and their structure and power source understood is with optical and near-infrared integral field spectroscopy (IFS). I will present new IFS results on the ionized, neutral, and molecular gas phases of nearby quasar-driven outflows to illustrate their properties and their potentially strong impact on their host galaxies.

11.4 Measuring ISM content of AGN and ULIRGs

Nick Scoville (Caltech)

I will discuss briefly use of dust continuum measurements for measuring ISM contents of AGN and ULIRG host galaxies with ALMA. I will present results for a sample of 180 galaxies at $z = 1$ to 6 observed in ALMA Cycle 2. The galaxy samples probe a range of a factor 5-10 in stellar mass and a factor 20 in specific SFR relative to the main sequence at each redshift.

11.5 A Turn-over in the Galaxy Main Sequence of Star Formation at M* ~ 10^10 Msun

David B. Sanders (University of Hawaii)

The relationship between galaxy star formation rates (SFR) and stellar masses (M*) is re-examined using a mass-selected sample of ~62,000 star-forming galaxies at z < 1.3 in the COSMOS 2 deg2 field. We measure infrared luminosities and SFRs using photometry from Herschel-PACS and SPIRE, Spitzer 24μm, and restframe (NUV-r) vs. (r-K) color. We find that the relationship between median SFR and M* follows a power-law at low stellar masses, but flattens to nearly constant SFR at high stellar masses. We describe a new parameterization that provides the best fit to the main sequence and characterizes the low mass power-law slope, turnover mass, and overall scaling of the relationship. The turnover in the main sequence occurs at a characteristic mass of about M0 ~ 10^10 Msun at all redshifts. The low mass power-law slope ranges from 0.9-1.3 and the overall scaling of the main sequence rises as (1+z)^4.2±0.10. A broken power-law fit below and above the turnover mass gives relationships of SFR ∝ (M*)^0.88±0.06 below the turnover mass and SFR ∝ (M*)^0.27±0.04 above the turnover mass. On average, galaxies more massive than M* > 10^10 Msun have a much lower specific star formation rate (SSFR = SFR/M*) than would be expected by simply extrapolating the traditional linear fit to the main sequence found for less massive galaxies. We also stack new Chandra observations of the full COSMOS field to estimate the contribution of AGN to quenching in these massive galaxies.

Friday, January 12th

12.1 Tracing Merger-fueled AGN Activity with Dual AGN and Offset AGN

Julie Comerford (University of Colorado Boulder, USA)

In order to study the link between galaxy mergers and AGN, we require a clean observational tracer of AGN in mergers. One such tracer is possible with kpc-scale separation supermassive black hole pairs in ongoing galaxy mergers. Dual AGN are the systems where both black holes are fueled as AGN, whereas offset AGN are the systems where only one of the black holes is an AGN. I will present multiwavelength approaches to building catalogs of dual AGN and offset AGN, and show the results of our observing campaigns. Finally, I will discuss what our results imply about whether galaxy mergers preferentially fuel the most luminous AGN.

12.2 Are luminous AGN triggered by galaxy interactions?

Cristina Ramos Almeida (Instituto de Astrofisica de Canarias)

Despite speculation that nuclear activity in galaxies may be triggered by mergers and interactions, very little is known about the true nature of the link. I will present deep Gemini/GMOS imaging of powerful radio galaxies and quasars which reveal that 95% of their galaxy hosts show signs of interactions at relatively high levels of surface brightness. Moreover, the galaxy morphologies are consistent with the AGN being triggered at any stage of the interaction. By comparing with a control sample of quiescent early-type galaxies, we find that the percentage of morphological disturbance in the radio galaxies is

significantly higher when similar surface brightnesses are considered. Finally, I will discuss the role of the environment in the triggering of powerful radio-loud and radio-quiet quasars. The difference between their environments supports a physical origin of radio loudness, with high density gas environments favouring the transformation of AGN power into radio luminosity, or alternatively, affecting the properties of the supermassive black holes themselves.

12.3 AGN Activity at the Quenching Threshold at z~2

Dale Kocevski (Colby College)

The discovery of massive "red nugget" galaxies at z=2 indicates that early quiescent galaxies were remarkably compact compared to their present-day counterparts. Using HST/WFC3 imaging from the CANDELS survey and ultra-deep Chandra observations, we have identified a large population of compact, star forming galaxies that host rapidly growing supermassive black holes at z=2-2.5. Based on their size, stellar mass, and star formation rates, these galaxies are likely the direct progenitors of the red nugget population. Our findings suggest the first generation of quenched galaxies emerged in the early Universe directly following a phase of rapid SMBH growth. I will discuss the properties of these galaxies and what they are revealing about the connection between AGN activity and the rise of the red sequence at z~2.

12.4 Fueling SMBHs: Mergers vs Smooth Accretion

Jillian Bellovary (Vanderbilt University, USA)

There is debate regarding whether massive black holes (MBHs) are primarily fueled by major merging events, or whether more quiescent "cold flow" accretion can efficiently fuel them as well. Previous results from Bellovary et al (2013), which used a set of zoomed-in cosmological simulations of high-redshift progenitors of massive galaxies, found that there is a preference for MBHs to accrete cold flow gas as opposed to gas of shocked or merger origin. However, this result is a consequence of the fact that the entire galaxy has a higher fraction of gas from cold flows. We tested this result, that each black hole tends to accrete the same fractions of smooth- and merger-accreted gas as is contained in its host galaxy, on a set of Milky Way-type disk galaxies simulated to z=0. Contrarily, we find that for one galaxy with a very active merger history, the central MBH exhibits a strong preference for accreting gas which was present in the secondary galaxy during a major merger. We will present our analysis of why one galaxy exhibits such a preference for merger-origin gas, while others show no bias at all, in the context of populations of AGN fueling and evolution over cosmic time.

12.5 Tracing Black Hole Growth Through Major Mergers

Anne Medling (Australian National University)

We present near-infrared integral field spectroscopy from Keck OSIRIS of the central regions of a sample of nearby (U)LIRGs in major mergers. The high spatial resolution of these data (inside the sphere of influence of the black holes) enables dynamical black hole mass measurements of dusty merging galaxies for the first time. We compare black hole mass measurements using stellar kinematics (traced by the CO molecular bandheads), ionized gas kinematics (traced by Brackett gamma), and molecular gas kinematics (traced by the H_2 1-0 S(1) line at 2.12 microns), and find reasonable agreement between them, although H_2 emission is often associated with turbulent inflow/outflow that can affect dynamical modeling. By measuring black hole masses in mergers and comparing with black

hole scaling relations, we test the timescales of merger-induced coevolution of black holes and their host galaxies. We find that black holes in later stages of merging tend to lie above local black hole scaling relations, suggesting that the black holes accrete mass more quickly than the bulges grow for these objects. This is contrary to the theory that black holes grow later, shutting off star formation in a sudden burst of quasar-mode feedback. These may be reconciled, however, by a scenario in which black hole feedback is delayed relative to its accretion time (e.g. by viscous accretion disks). Alternatively, these measurements may indicate a mass pileup below r~20pc, potentially providing a gas reservoir for material entrained in massive AGN-driven outflows.

12.6 Spatially Resolved Imaging and Spectroscopy of Candidate Dual AGNs

Rosalie McGurk (University of California Santa Cruz)

Finding close pairs of active galactic nuclei (AGNs), or dual AGNs, in galaxy mergers remains a challenge. The presence of double-peaked [O III] has been proposed as a technique to select dual AGNs efficiently. We studied a sample of double-peaked narrow [O III] emitting AGNs from SDSS DR7. By obtaining new and archival high spatial resolution images taken with the Keck 2 Laser Guide Star Adaptive Optics system and the near-infrared (IR) camera NIRC2, we showed that 30% of double-peaked [O III] emission line SDSS AGNs have two spatial components within a 3" radius. However, spatially resolved spectroscopy or X-ray observations are needed to confirm these galaxy pairs as systems containing two AGNs. We followed up these spatially-double candidate dual AGNs with integral field spectroscopy from Keck OSIRIS and Gemini GMOS and with long-slit spectroscopy from Keck NIRSPEC and Shane Kast Double Spectrograph. We find double-peaked emitters are caused sometimes by dual AGN (25%) and sometimes by outflows (42%), narrow line kinematics (25%), or AGN/starbursting galaxy pairs (8%). We also performed Chandra X-ray ACIS-S observations on 12 double-peaked candidate dual AGNs. Using our observations and 8 archival observations, we compare the distribution of X-ray photons to our spatially double near-IR images, measure X-ray luminosities and hardness ratios, and estimate column densities. By assessing what fraction of double-peaked emission line SDSS AGNs are true dual AGNs, we can better determine whether double-peaked [O III] is an efficient dual AGN indicator and constrain the statistics of dual AGNs.

13.1 The Spectroscopic Signature Close, Bound, Binary Supermassive Black Holes

Mike Eracleous (Penn State University)

Bound binary supermassive black holes at close separations (< 1 pc) are thought to be one of the last stages of the evolution of black hole pairs that result from the merger of their parent galaxies. They have also been suggested as explanations for a number of other astronomical observations (e.g., precessing radio jets and X-shaped radio sources). However, no confirmed cases are known and few plausible candidates exist. In this talk I will review the methods used to search for such systems, emphasizing an optical spectroscopic technique aimed at finding radial velocity variations of the broad emission lines from gas that is bound to the black holes. I will also summarize the results from this method to date and close by describing future prospects.

13.2 Simulations of AGNs in isolated disk galaxies

Jared Gabor (CEA Saclay)

Observations indicate that most AGNs occur in normal, isolated disk galaxies. Using idealized high-resolution simulations, we uncover the mechanism for this black hole growth in gas-rich disks. Unstable gas disks form dense, massive clouds that can exchange angular momentum with other gas clouds, eventually spiraling toward the galactic nucleus. Dense clouds colliding with the central black hole can drive Eddington-limited accretion bursts, typically lasting 5-10 Myrs. These bursts can explain most or all of the black hole growth implied by observed z~2 AGNs. We also show that these accretion events drive powerful outflows, with outflow rates near the SFR. Despite these powerful outflows, AGNs have little impact on star-formation in the galactic disk.

13.3 Combined effects of several AGN and stellar feedback models on galaxy evolution

Orianne Roos (CEA-Saclay)

With high-resolution simulations of star-forming disk galaxies at high redshift, we study the effects of combined AGN and stellar feedback models on the host-galaxy.
AGN feedback is modeled using a standard thermal recipe of feedback (gas is heated and pushed away) plus a post-processing method to compute AGN ionization. We first consider AGN feedback only and show that, even though the AGN generates powerful outflows, the effects of AGN feedback on star formation is relatively weak on time-scales up to a few 100s of Myrs, even when long-range radiative feedback is accounted for.
As the combination of stellar feedback models generates outflows that are more powerful than the sum of the models taken separately, combined AGN and stellar feedback may also couple non-linearly and produce very fast outflows, with important outflow rates. We then include several stellar feedback sources on top of AGN feedback, such as young stars creating HII regions through radiative pressure and supernovae releasing thermal and kinetic energy in the ISM.
We follow their impact on high-resolution simulations and study the coupling between the different sources of outflows (AGN, young stars, supernovae). How do these feedback-driven winds affect the host ? Do they change the distribution of existing stars ? How much gas do they expel and what is the consequence for star formation ?

13.4 Torque-limited growth of massive black holes in galaxies

Daniel Angles-Alcazar (CIERA - Northwestern University)

Unveiling the AGN-galaxy connection through cosmological hydrodynamic simulations faces a remarkable challenge: linking the physical conditions on galactic scales with the relevant processes that govern black hole growth at scales orders of magnitude below. A simple analytic argument shows that the black hole mass dependence of the accretion parametrization may have significant implications on the inferred connection between massive black holes and galaxies. A strong dependence on black hole mass (as in the Bondi spherical prescription) implies the requirement of strong self-regulation by feedback processes. In contrast, a model based on the transport of angular momentum by gravitational instabilities, weekly dependent on black hole mass, shows that feedback self-regulation may not be required. In this torque-limited growth scenario, black holes and galaxies evolve on average toward the observed scaling relations, regardless of the initial conditions, and with no need for mass averaging

through mergers or additional self-regulation processes. Outflows from the accretion disk play a key role by providing significant mass loss, but there is no need for strong interaction with the inflowing gas in order to regulate black holes in a non-linear feedback loop. Cosmological simulations including a fully consistent treatment of torque-limited black hole growth and outflows provide support to this picture.

13.5 Supermassive blackhole activation in gas-rich merging galaxies revealed from high-spatial-resolution AO-assisted infrared imaging observations with Subaru 8.2m telescope

Masatoshi Imanishi (Subaru Telescope)

We present the results of infrared K- (2.2 micron) and L'-band (3.8 micron) high-spatial-resolution (<0.2") imaging observations of nearby gas/dust-rich infrared luminous merging galaxies, assisted by the adaptive optics (AO) system on the Subaru 8.2-m telescope.
We investigate the presence and frequency of red K-L' compact sources, which are sensitive indicators of active galactic nuclei (AGNs), including highly obscured AGNs, because of low dust extinction in these infrared wavelengths.
We detected at least one AGN in all but one observed merging galaxies (28/29), demonstrating the power of our method for the purpose of detecting deeply buried AGNs in merging galaxy nuclei.
However, luminous multiple AGNs (=dual AGNs) were detected in only ‾15% of observed merging galaxies.
For multiple nuclei sources, we compared the estimated AGN luminosities (or upper limits) with supermassive black hole (SMBH) masses inferred from large aperture K-band stellar emission photometry in individual nuclei.
We found that in gas/dust-rich merging galaxies, larger-mass SMBHs are generally more actively mass accreting when normalized to SMBH
mass (i.e., higher Eddington ratios), suggesting that larger mass SMBHs in more massive galaxies could have stronger feedback to galaxies
(Imanishi and Saito 2014 ApJ 780 106). This general trend may be related to the AGN feedback scenario as the possible origin of the galaxy downsizing phenomenon, where more massive galaxies have finished their major star-formation quickly due to stronger AGN feedback, and so generally show redder colors than less massive galaxies.

14.1 Fading AGN, feedback, and AGN demographics

William Keel (University of Alabama)

Roughly 0.1% of SDSS spectroscopic AGN (and a larger fraction of H I-selected AGN) are accompanied by extended emission-line regions on scales 10 kpc and larger. In about 40% of these, the AGN falls short of the energy budget implied by photoionization of the clouds by as 1-3 orders of magnitude, implying that the AGN have faded over the relevant light-travel times. All these are in interacting or postmerger systems, possibly needed or sufficient distant, cold H I to trace the AGN's ionization history. In many of the fading candidates, low abundances and quiescent kinematics indicate that we see photoionized tidal debris rather than outflowing material. Light curves derived from recombination balance show e-folding times from centuries to a few millenia, short compared to simple accretion-disk expectations. These rapid, large-amplitude changes may be associated with SMBHs in binary systems or with local feedback processes. They do suggest that the demographics of accreting SMBHs are broader than derived from ongoing AGN signatures alone.

14.2 Catching quenching galaxies: following the road less traveled from blue spirals to red ellipticals

Katherine Alatalo (IPAC/Caltech)

Feedback on the interstellar medium of galaxies by outflows driven by Active Galactic Nuclei is an essential component of many models of galaxy formation, but an example of an AGN outflow directly affecting the star formation (SF) efficiency in the resident molecular gas has not been observed. Here we present millimeter-wave observations from ALMA and CARMA of the gas and dust continuum of NGC 1266, which hosts an AGN-driven outflow, finding that SF is very suppressed in the nuclear region. The ratio of the SF rate surface density (ΣSFR) to the gas surface density (ΣH2) reveals that SF is suppressed by a factor of ≈ 70 in the molecular gas compared to normal star-forming galaxies. The AGN-driven outflow can account for this extreme suppression by injecting turbulence into the molecular gas, regulating SF while simultaneously hindering black hole growth, providing an example of regulation that can the M-σ relation at intermediate scales. Finding galaxies like NGC1266 has the potential to shed light on the nature of galaxy transformation, and I discuss the Shocked Poststarburst Galaxy (SPOGS) survey, designed to find these "needles in the haystack", which has discovered both some expected, as well as unexpected results.

14.3 Observations of Massive Ionized Outflows from Radio-Loud AGNs

Hsin-Yi Shih (Gemini Observatory - North)

We investigate the evolution and physical properties of massive ionized outflows driven by powerful radio jets at z < 0.6. We present IFU observations of outflows from (1) a sample of very young radio sources, and (2) a matched sample of evolved radio galaxies and quasars. The outflows from the young radio sources are markedly different from their more evolved counterparts, with the young outflows having much stronger morphological and kinematic alignments with the radio axes. They also have distinct velocity components providing clues to the different driving mechanisms that may be involved at these early stages. On the other hand, although the more evolved outflows appear to have weaker alignments with the radio structures, their orientations are not completely random. Through comparing a sample of quasars and radio galaxies with matched radio properties, we found that the 3-D structure of the evolved outflows are likely wide angle bi-cones centered around the radio axes. The average estimated mass of these outflows is ~3 x 10^8 solar masses, and the average outflow rate is ~30 solar masses per year.

14.4 Wide spread AGN driven nuclear outflows in massive z~1-2 star-forming galaxies

Dieter Lutz (MPE)

I will present near-infrared imaging spectroscopic evidence on outflows from z~1-2 star forming galaxies, including the recent discovery of almost ubiquitous nuclear and plausibly AGN-driven outflows in massive log(M*)>10.9 main sequence type star forming galaxies. These outflows may mark a decisive quenching point in the life of massive galaxies, in the framework of the 'equilibrium' picture of galaxy evolution and the mounting evidence for AGN-driven outflows in star forming galaxies in other contexts. The high incidence rate, at least as large as that of AGNs identified by other indicators, provides a new view on presence of AGN at the peak of cosmic star formation, and on the influence of variability on the AGN census.

14.5 Ionized Gas Outflows of Type 2 AGNs: IFU Investigation, 3-D Outflow Models, and Census with a Large Sample

Hyun-Jin Bae (Yonsei University)

We investigate AGN-driven outflows as a tracer of AGN feedback in 3-fold approach. First, we present IFU observations of a unique sample of type 2 AGNs. The sample is selected from SDSS DR7 with a luminosity-limit (L[O III] > 10^41.5 erg/s) as well as strong kinematic signatures of ionized gas outflows (blue- or redshift of [O III] > 200 km/s or FWHM of [O III] > 1000 km/s), defining an extremely rare population (< ~0.5%). We present the detailed gas kinematics of 12 AGNs based on the Magellan/IMACS-IFU and VLT/VIMOS observations, and the physical parameter of the outflows. Second, we present 3-dimensional biconical outflow models for constraining the observed kinematics of gas outflows. With simple assumptions on the velocity gradient, inclinations of bipolar outflows, and host galaxy dust extinction, we simulated flux, velocity, and dispersion maps of outflows in 2-d projected plane, in order to reproduce the IFU observations. Third, extending our study to a large statistical sample, we present a census of ionized gas outflows of ~23,000 SDSS type 2 AGNs based on our recent studies (e.g., Bae & Woo 2014, ApJ, 795, 30). We find that ~50% of type 2 AGNs show a significant [O III] velocity offset (i.e., projected velocity > 20 km/s). AGNs show a fan-shape distribution in the [O III] velocity-velocity dispersion diagram, which can be well reproduced by the Monte Carlo simulation of the 3-d biconical outflow models, indicating that the observed kinematics of [O III] are well explained by the biconical outflows with relatively high launching velocities.

POSTERS ABSTRACTS

(in order of presentation)

Group 1

1.1 Extensive observations of the Galactic Center with ATCA

Abhijeet Borkar (University of Cologne)

The Galactic Center harbors a compact radio source, called Sagittarius A* (Sgr A*), which is associated with the 4 million solar mass super-massive black-hole (SMBH), located approximately 8 kpc away. Sgr A* is currently classified as inactive, although it is known to undergo regular flaring events in infrared, X-ray and submilimeter wavelengths, which suggests that it accretes matter sporadically. Its proximity allows us to study the immediate vicinity of a SMBH and compare its properties with nearby low luminosity active galactic nuclei.
We observed the Galactic Center at 3mm with the Australian Telescope Compact Array between 2010 and 2014, with four days of observation each year. The location of the telescope in the southern hemisphere allows us to observe the Galactic Center for more than 10 hours. This makes it the most extensive dataset of observations of Sgr A* at 3mm. We detect few instances of variability and flaring activity of Sgr A*, among days of stable output. Here I will present the modelling of the physical processes giving rise to the variable emission of Sgr A* and report the analysis of the observed flaring events.

1.2 Matching theoretical predictions to the observed M – σ data

Adam Larkin (Keele University)

Observations of elliptical galaxies and bulges show a strong correlation between the masses of their super-massive black holes (SMBH), MBH, and their stellar velocity dispersions, σ. One current idea is that this MBH–σ relation is established via SMBH feedback in gaseous protogalaxies. Models based on this idea generally consider momentum-driven or energy-driven outflows, where the gas directly traces the dark matter. Models of momentum-driven outflows in particular lead to a theoretical prediction, relating MBH to the peak of the dark matter circular speed curve, Vc,pk. To compare this prediction to the data, we consider the relation between Vc,pk and the stellar σ in local spheroids, allowing for segregation between stars and dark matter.
We solve the isotropic Jeans equation, parameterised by the stellar to dark matter mass ratio, f(r)=M∗(r)/Md(r), for the 1-D stellar velocity dispersion, σr. One of our key parameters is the mass ratio inside a sphere with the stellar effective radius, f(Re)≡fe, which we allow to be different to the global mass ratio.
We project σr along the line of sight, and average over a disc of radius Re , to find the aperture dispersion, σap(Re), which is the velocity scale used in empirical M –σ relations, as a function of Vc,pk and fe. Combining the theoretical M–Vc,pk relation with our Jeans modelling, we predict MBH as a function of σap(Re) and compare with M–σ data. We find good agreement for fe∼1−5, values that are consistent with the derived dark matter fractions

from samples of local, giant ellipticals.

1.3 High-ionization gas in active galactic nuclei: prime evidence of AGN feedback

Alberto RodrIíguez Ardila (Laboratorio Nacional de Astrofísica)

We present AO IFU K-band observations of four Seyfert galaxies aimed at studying the high-ionization gas in the nuclear region of AGN. The high-spatial and high-spectral resolution sampling allowed us to study the [Si VI] and [CaVIII] coronal line (CL) emission at scales down to 10 pc, covering ionization potentials up 200 eV. The observations reveal in all cases very rich and complex structures, both in terms of velocity fields and gas distribution not detected in the low-ionization and molecular gas. The CL emission is elongated preferentially along the radio-axis, with clear signs of knots coinciding with those observed in the radio and X-ray maps. The morphology and the kinematics of the near-infrared CLs are in very good agreement with the ones displayed by optical CLs and the ionized gas overall, suggesting a common origin. The line flux distributions, velocity maps and ionization structure suggest that the radio jet plays an important role in the structure and kinematics of the CL region, making these lines prime evidence of feedback processes in the few tens of parsecs of the central engine.

1.4 Circumbinary accretion onto supermassive black holes

Alex Dunhill (Pontífice Universidad Católica)

I will present the results of SPH simulations of accretion onto binary systems, in the context of merging supermassive black hole binaries. I will show how prograde and retrograde accretion events produce quantifiably different circumbinary environments, and how theses systems evolve. I will also present the results of new simulations of circumbinary accretion when the binary has significant eccentricity (as may be expected for a SMBH binary) and discuss the strong implications for searches for accreting binary supermassive black hole binaries in the universe.

1.5 Clustering-based redshifts of WISE galaxies and quasars

Alexander Mendez (Johns Hopkins University)

We present the clustering-based redshift estimation of millions of extragalactic sources detected by the Wide-field Infrared Survey Explorer (WISE) using the data-driven method proposed by Menard et al. (2013). This technique derives redshift distributions from measurements of spatial correlations without any assumption on spectral energy distributions. Applying it to the entire WISE dataset as a function of brightness and colors we present the redshift distributions of WISE sources, including passive & star-bust galaxies as well as obscure and unobscured quasars.

1.6 The black hole mass/pitch angle relation of Type I AGN in spiral galaxies

Amanda Schilling (University of Arkansas, Fayetteville)

A relationship between the mass of supermassive black holes, M, at the center and the pitch angle, P, a

measure of tightness of spiral arms, was recently reported by Berrier, J.C., et al., (2013, ApJ, 769, 132) for late type galaxies. The relationship, established for a local sample (z<0.04), shows that spiral galaxies with tighter pitch angles contain higher mass black holes. In this work, we explore the M-P relation for a sample of moderate to high redshift (0.06<z<1.4) spiral galaxies that host a Type I AGN. These objects were selected from the SDSS quasar catalog, the GOODS fields, and the XMM-COSMOS survey (Lusso, E., et al., 2010, A&A, 512, A34) and have published spectra available. The broad Hβ and MgII emission lines were used with the broad-line mass scaling relations to estimate M. Pitch angles were measured using a 2DFFT technique (Davis, B.L., et al., 2012, ApJS, 199, 33). The M-P relation for the higher redshift AGN sample again shows that tighter pitch angle s correlate to higher mass black holes, however, with a shallower slope. We discuss this result as possible evolution in the M-P relation or as a means to explore other properties of the disk galaxies.

1.7 The cosmic growth of the active black hole population

Andreas Schulze (Kavli IPMU)

We present a census of the active black hole population from z=0 to z=2, with an emphazise on 1 < z < 2, by studying the bivariate distribution function of black hole mass and Eddington ratio. The study of the active black hole mass function (BHMF) and the Eddington ratio distribution function (ERDF) allows to clearly disentangle the AGN downsizing phenomenon, present in the AGN luminosity function (AGN LF), into its physical processes of black hole mass downsizing and accretion rate evolution. We are utilizing type 1 AGN samples from 3 optical surveys (VVDS, zCOSMOS and the SDSS), that cover a wide range in luminosity over our redshift interval of interest. We investigate the cosmic evolution of the AGN population as a function of AGN luminosity, black hole mass and accretion rate. Compared to z = 0 we find a distinct change in the shape of the BHMF and the ERDF, consistent with downsizing in black hole mass. The active fraction or duty cycle of type 1 AGN at z~1.5 is almost flat as a function of black hole mass, while it shows a strong decrease with increasing mass at z = 0. We are witnessing a phase of intense black hole growth, which is largely driven by the onset of AGN activity in massive SMBHs towards z = 2.

1.8

Anirban Bhattacharjee (Sul Ross State University/University of Wyoming)

1.9

Everton Lüdke (Universidade Federal de Santa Maria)

1.10 Signposts of Co-evolution at high z: properties of Submm-bright QSOs at z~2

Anuar Khan Ali Franco (Instituto de Física de Cantabria (IFCA))

We present a detailed study of a X -ray selected sample of 5 submillimetre bright QSOs at z~2, where the highest rates of star formation (SF) and growth of black holes (BH) occur. Therefore, this sample is a great laboratory to investigate the co-evolution of star formation and AGN. We present here the analysis of the spectral energy distributions (SED) of the 5 QSOS, including new data from Herschel

PACS and SPIRE.
Both AGN (direct and reprocessed) and Star Formation (SF) components are needed to model its SED. From the SED and their UV-optical spectra we have estimated the mass of the black hole (M_BH = 10^9 - 10^10 M_SUN) and bolometric luminosities of the AGN (L_BOL = (0.8-20)*10^13 L_SUN). These objects show very high luminosities in the far infrared range (at the H/ULIRG levels) and very high rates of SF (SFR = 400-1400 M_SUN). Once known their current SFR and their BH masses, we deduce that their host galaxies must be already very massive, or they would not have time to get to the local relation between BH mass and bulge. We have found a significant correlation between the growth of galaxies via star formation and the growth of their central SMBH via accretion (Lx). Finally, we have found evidence of a possible correlation between the column density of ionised gas detected in X-rays.

1.11 Tracing Quasar Narrow-Line Regions Across Redshift

Aycha Tammour (Western University)

In a single optical spectrum, the quasar narrow-line region (NLR) reveals low density, photoionized gas in the host galaxy interstellar medium, while the immediate vicinity of the central engine generates the accretion disk continuum and broad emission lines.
To isolate these two components, we construct a library of high S/N quasar optical composite spectra created from the Sloan Digital Sky Survey Data Release 7 (SDSS-DR7). For our median composites, we use homogeneous subsamples that include objects with similar Eddington accretion rates and black hole masses. This binning structure is designed to search for redshift evolution in quasar host galaxies as revealed by forbidden narrow emission lines while controlling for the properties of the central engine; the high S/N spectra allows us to detect and measure weak lines such \nev$\lambda$3427.
We find that the high IP lines' luminosities show no evidence of increase with redshift consistent with no evolution in the AGN SED or the host galaxy ISM illuminated by the continuum.
In contrast, we find that the \oii\ line becomes stronger at higher redshifts, and we interpret this increase in the line luminosity as a consequence of enhanced star formation contributing to the \oii\ emission in host galaxies at higher redshifts. The SFRs estimated from the \oii\ luminosities show a flatter increase with z than non-AGN galaxies given our assumed AGN contribution to the \oii\ luminosity.
Finally, we confirm an inverse correlation between the strength of the \feii$\lambda4570$ complex and both the \oiii\ EW (though not the luminosity) and the width of the \hb\ line as known from the eigenvector 1 correlations.

1.12

Bhaskar Agarwal (Yale University)

1.13 Star formation to supermassive black holes from distant radio galaxies

Brigitte Rocca-Volmerange (Institut Astrophysique de Paris)

Continuous multiwavelength SEDs of distant radio galaxies (z ~4) of the Herge catalog are fitted with the help of the evolution code Pegase.3. From the optical to the submm, including Spitzer and Herschel

data, the respective identifications of star population and AGN emissions constrain the supermassive blackhole growth with stellar evolution, clarifying the physical link from galaxy to AGN.

1.14 Redshift of NuStar Serendipitus Hard X-Ray Emitters

Carla Fuentes (Universidad de Concepción)

Since the first discovery of the Cosmic X-ray Background (CXRB), astrophysics try to determine in detail its composition. One of the most important advances are from Chandra and XMM-Newton surveys, they already resolve just about 80% of the CXRB < 8 keV. When we study at higher energies, only the 4% of the CXRB are resolved. Now, thanks to NuStar, we can study X-ray surces at ∼20-30 keV peak and thus get a better understand of the growth of the supermassive black hole.
NuStar it is observing known AGNs and find serendipitus sources arround them. So far it is detect 149 serendipitous sources, but only 69% has spectroscopic redshift. These sample is divided by those observed in the northern hemisphere and southern hemisphere. In this context, this project will be obtained spectroscopic redshift from the Southern Hemisphere. I will present the first 17 redshifts obtained from the Magellan Telescope, MagE echelle spectrograph.

1.15 Molecular Gas Excitation in AGN Host Galaxies and Submillimeter Galaxies at z~2

Chelsea E. Sharon (Cornell University)

Theoretical work has suggested that AGN may play an important role in quenching star formation in massive galaxies. Due to sensitivity demands, direct evidence for AGN affecting the molecular ISM (the gas phase that fuels star formation) has so far been limited to recent detections of molecular outflows in a small number of low-redshift systems. Indirect evidence for an interplay between AGN and their host galaxies' cold gas phase may be provided by measurements of the gas excitation (and dynamics). At z~2-3, the peak epoch of star formation and AGN activity, previous observations of the CO(1-0) line revealed that submillimeter galaxies have substantial reservoirs of cold molecular gas. However, the molecular gas in AGN-host galaxies appears highly excited, potentially supporting an evolutionary connection between these two populations. We will present a new larger sample of CO(1-0) detections from the Jansky Very Large Array for z~2 submillimeter galaxies and AGN-host galaxies with existing CO(3-2) detections that allow us to better compare the low-excitation molecular gas properties of these systems and further investigate potential evidence for gas excitation due to active black holes.

Group 2

2.16 The evolution of AGN - an X-ray view

Claudio Ricci (Pontificia Universidad Católica de Chile)

Understanding the evolution of AGN is a key step to shed light on how supermassive black holes and their host galaxies interact. Hard X-ray selected samples are extremely well suited to detect, classify

and study heavily obscured Active Galactic Nuclei, and to understand the evolution of their circumnuclear material. In my talk I will report on the results obtained by studying the broad-band X-ray emission (0.3-150 keV) of the 830 AGN reported in the Swift/BAT 70 months catalog. Our work is to date the largest study of broad-band X-ray observations of AGN ever performed, and was obtained by combining observations carried out by XMM-Newton, ASCA, Suzaku, Chandra, Swift/XRT and Swift/BAT, for a total of more than 1,500 X-ray spectra. In my presentation I will focus on the evolution of the absorption and X-ray spectral properties of hard X-ray selected AGN, on their luminosity functions, and on the impact of our findings on the understanding of the cosmic X-ray background.

2.17 Are Luminous Quasars at z ~ 4 Tracers of the Most Massive Dark Matter Halos?

Cristina Garcia (PUC - MPIA)

In the standard picture of structure formation, the first massive galaxies form in the highest peaks of the density field, which are the cores of massive protoclusters. Such structures must be exceedingly rare, and thus hard to find. Luminous QSOs at z ~ 4 are the most strongly clustered population in the Universe, and this large auto-correlation demands that they reside in massive DM halos, associated with large overdensities of galaxies. Thus the generic prediction is a strong QSO-galaxy cross-correlation for luminous QSOs at z ~ 4. Here I present VLT/FORS observations of 5 z ~ 4 quasar fields. These quasars have been selected to have very massive black holes (> 10^9 Msol). Using a nobel narrow band filter technique we have selected Lyman Break Galaxies (LBG) associated with each quasar in a very narrow redshift range (dz ~ 0.1). Here, I will present the first QSO-LBG cross correlation function measurement at z ~ 4. I will show a comparison between the LBG density in these fields with the LBG density expected in blank fields in order to find out whether luminous QSOs at z ~ 4 trace the most massive dark matter halos in the Universe. Also these results allow us to study the impact of AGN feedback in their environs and help us to probe the extreme limits of the hierarchical buildup of structure over the first ∼ 10% of the cosmic time.

2.18 Alignments of quasar axes with large-scale structures

Damien Hutsemékers (University of Liège)

Based on measurements of optical linear polarization of quasars belonging to large groups at redshift ~ 1.3, we found that quasar spin axes are likely parallel to their host large-scale structures. These observations can put constraints on the co-evolution of AGN, galaxies and large-scale structures.

2.19 Nuclear star formation at the hundred parsec scale: the AGN-starburst relation

Daniel Ruschel Dutra (Universidade Federal do Rio Grande do Sul)

It has been well established in the past decades that the central black hole masses of active galactic nuclei (AGN) correlate with dynamical properties of their harbouring bulges. This notion begs the question of whether there are causal connections between the AGN and its immediate vicinity in the

host galaxy. In this paper we analyse the presence of circumnuclear star formation in a sample of mid-infrared observations of 16 AGNs. The observations consist of a set of 11.3{\mm} PAH emission and reference continuum images, taken with ground based telescopes, with sub-arcsecond resolution. By comparing our star formation estimates with AGN accretion rates, derived from X-ray luminosities, we investigate the validity of theoretical predictions for the AGN-starburst connection. Our main results are: i) circumnuclear star formation is found, at distances as low as 20 pc from the nucleus, in half of our sample; ii) star formation luminosities are correlated with the bolometric luminosity of the AGN only for luminous objects (L_AGN >= 10^42 erg s^-1); iii) low luminosity AGNs (L_AGN < 10^42 erg s^-1) tend to have starburst luminosities greater than their bolometric luminosities.

2.20 Ultra-deep sub-arcsec radio observations of GOODS-N: the nature of the sub-mJy

Daria Guidetti (Istituto di Radioastronomia INAF)

I will present ultra-deep JVLA mosaic observations of the GOODS-N region at 5 GHz with sub-arcsec resolution, obtained in preparation of the e-MERLIN legacy programme eMERGE (PI T. Muxlow). With a central rms of 1.5 microJy, this represents the most sensitive survey carried out at this frequency. By using previous 1.4 GHz and multiwavelength data, we tried to identify the nature of the sub-mJy population down to a few microJy, with particular attention to faint AGN cores in moderate-to-high redshift (1< z <4) galaxies.

2.21 Testing AGN feedback: An observational approach

Darshan Mahesh Kakkad (European Southern Observatory)

Feedback from accreting SMBHs has become a key element in modelling galaxy evolution. From the observational side there is the mounting evidence that AGN outflows are ubiquitous but still there is no general consensus on the impact that they may have on their host galaxies. We will present recent SINFONI observations devoted to study the velocity structure of the [OIII]5007 line for four radio-quite quasars at z~1.5. The targets were selected for their peculiar values of mass accretion rates, Eddington ratios and column densities which strongly suggest that they are in an active outflowing phase. We will present the overall properties of the selected candidates, and discuss the impact that their outflows may have on the host galaxy.

2.22 Constraining the Molecular Outflows in Hyper−Luminous Infrared Galaxies

Diego Calderón (Pontificia Universidad Católica de Chile)

Recent studies have presented observational evidence for molecular outflows in Ultra-Luminous Infrared Galaxies (ULIRGs). Neutral NaD, molecular OH and CO outflows at velocities >1000 km/s coming from the nucleus would indicate this process cannot be produced by the starburst components of the systems alone. Furthermore, they have reported a correlation between these outflows velocities and the AGN luminosity fraction for these galaxies. However, none of these works has included the most powerful luminous infrared galaxies, the Hyper-Luminous Infrared Galaxies (HLRGs). In this

work, we have analyzed, for the first time, a sample of 5 HLIRGs in order to constrain their molecular outflows. We have examined Herschel spectra at 119um, observing the molecular OH doublet to measure the velocity of such outflows. Three out five of our galaxies present the OH doublet feature, however they do not seem to conform to previously studied correlations. We discuss implications and future possibilities.

2.23 A multi-wavelength exploration of the [CII] deficit in H-ATLAS/GAMA galaxies out to z=0.2

Edo Ibar (Universidad de Valparaiso)

We explore the behaviour of [CII]-157.74um forbidden fine-structure line observed in a sample of 28 galaxies selected from ~50deg^2 of the Herschel-ATLAS survey. The sample is primarily constructed using galaxies with 160um flux densities higher than 150mJy and optical spectra from the GAMA survey. Far-IR spectra centred on this redshifted line were taken with PACS on-board the Herschel Space Observatory. The galaxies span 0.02<z<0.2, with 10<log(L_IR/Lo)<12 and 7.2<log(L_[CII]/Lo)<9.4, covering a variety of dust-emitting galaxy morphologies, including face- and edge-on disks, ellipticals and irregulars. The sample exhibits the so-called [CII] deficit at high L_IR, i.e. the [CII]/IR ratio decreases at high L_IR. We find significant differences between those galaxies presenting [CII]/IR>2.5x10^-3 with respect to those showing lower ratios. In particular, we find that galaxies with high ratios tend to have: (1) L_IR<10^11Lo; (2) colder dust temperatures, often Td<30K; (3) the presence of disk-like morphologies in SDSS r-band images; (4) WISE colours in the range 0.5<S_12u/S_22um<1.0; (5) low surface brightness Sigma_IR~10^8-9Lo/kpc^2, (6) and a wide range of specific star-formation rates, sSFR~0.01-3Gyr^-1. We suggest that the main parameter responsible for controlling the [CII]/IR ratio is the strength of the far-UV radiation fields (<G_O>). It is possible that relatively high <G_O> create a positively charged dust grain distribution, impeding an efficient photo-electric extraction of electrons from these grains to then collisionally excite carbon atoms. We find that within the brighter IR population, 11<log(L_IR/Lo)<12, the [CII] deficit is unlikely to be produced by [CII] self absorption or controlled by the presence of a moderately luminous AGN (identified via the BPT diagram).

2.24

Elena Murchikova (Caltech)

2.25 AGN in galaxy clusters

Elias Koulouridis (IAASARS, National Observatory of Athens)

We present a study of the overdensity of X-ray-selected active galactic nuclei in 33 galaxy clusters in the XMM-LSS field (The XMM-Newton Large Scale Structure Survey), up to redshift z=1.05. Previous studies have shown that the presence of X-ray-selected AGN in rich galaxy clusters is suppressed, since their number is significantly lower than what is expected from the high galaxy overdensities in the area. the reason for the deficiency of X-ray AGN in rich clusters is the strong gravitational potential, which provides the necessary conditions for the suppression, whichever these may be: gas stripping, strangulation, tidal stripping, evaporation, high velocity dispersion, etc. A similar relation between the strength of the gravitational potential and star formation quenching supports these results. To fully understand this relation, we need to trace its evolution as a galaxy approaches the cluster's gravitational potential, enters the hot

ICM, and crosses the cluster. To this end, we have investigated the occurrence of X-ray-selected AGN in low and moderate X-ray luminosity galaxy clusters in an attempt to trace back the relation between high-density environments and nuclear activity.

2.26 Properties of Narrow-line Seyfert 1 galaxies - fitting the misfits into the AGN scenario

Emilia Jarvela (Aalto University Metsahovi Radio Observatory and Dept. of Radio Science and Engineering)

Our understanding of active galactic nuclei (AGN) was challenged when Fermi detected gamma-ray emission from a handful of narrow-line Seyfert 1 galaxies (NLS1). The detection confirmed the presence of powerful relativistic jets in them. It was earlier presumed that relativistic jets can only be produced in massive elliptical galaxies with supermassive black holes. However, NLS1 galaxies are different compared to other gamma-ray emitting AGN; they have lower black hole masses and higher accretion rates, and reside mostly in spiral galaxies.
This poses questions concerning the AGN evolution; which properties are necessary to trigger and maintain AGN activity, and what are the evolutionary lines of the different populations? NLS1 galaxies, being the third gamma-ray emitting AGN class, also complicate the unification schemes considerably. NLS1 galaxies are a poorly studied class of AGN. It seems that a surprisingly large fraction of them are radio-loud and thus possibly host jets; but also some of them seem to be radio-silent. This, among other things, suggests that they do not form a homogeneous class. However, we do not know what causes the radio loudness, but, for example, the host galaxy type and the large-scale environment might play a role.
In this presentation we present results of a statistical study of a large sample of NLS1 sources. We discuss the interplay between their properties, such as emission properties, black hole masses, large-scale environments, and their effect on radio loudness. We also present the first results of the Metsahovi Radio Observatory NLS1 study at high radio frequencies.

2.27 High radio frequency study of Narrow-line Seyfert 1 galaxies

Anne Lahteenmaki (Aalto University Metsahovi Radio Observatory & Dept of Radio Science and Engineering)

Very few observations of Narrow-line Seyfert 1 (NLS1) galaxies exist at high radio frequencies. It has been usually presumed that they are faint at radio, but since the discovery of gamma-ray emission --- and hence relativistic jets--- from them, our understanding of their properties and how they fit into the AGN scenario has fundamentally changed. With the current scarce, non-simultaneous data reliable statistical and multifrequency studies, such as can easily be performed for the brighter active galactic nuclei (AGN), have so far been nearly impossible for NLS1 galaxies. To fix at least one part of the problem, we have initiated a large high frequency observing programme of NLS1 galaxies at Aalto University Metsahovi Radio Observatory. We perform 22 and 37 GHz multi-epoch observations of a large set of NLS1 sources, aiming to, first, confirm how many of them can be detected at these high frequencies, second, probe their variability over various timescales, and third, establish a r o bust sample for regular monitoring, multifrequency observations at higher energies, and modelling. One of our immediate scientific goals is to examine the various (sub)types of NLS1 galaxies that have started to emerge during this study, and determine how they might fit into the evolutionary and unification

schemes of AGN. Furthermore, we try to identify the mechanisms ---so far uncertain--- that produce the infrared emission in them. In this poster we present our programme, consisting currently of approximately 150 NLS1 sources and 13 other low-luminosity AGN.

2.28 The hard X-ray luminosity function of high-redshift (z>3) AGN

Fabio Vito (UNIBO-DIFA, INAF-OABo)

I will present the Hard X-Ray (2-10 keV) Luminosity Function (HXLF) of one of the largest sample of X-ray detected AGN from z=3 upto z=5.1 to date (141 objects), characterized by a redshift completeness close to 100 %. Data were collected from the 4 Ms CDF-S, SXDS, XMM-COSMOS and Chandra-COSMOS surveys. The use of wide and deep fields allowed us to sample both the high and the low luminosity regime (down to logL_X ~ 43), which is critical to constrain the high-redshift evolution. we accounted for the effect of obscuration on the survey sky coverages and applied a correction for the redshift incompleteness. A Maximum Likelihood Estimation method was implemented to fit the HXLF with widely-used evolutionary models. The results are consistent with a Pure Density Evolution model, but a more complex Luminosity-Dependent Density Evolution model cannot be excluded. We found that the space density of luminous (logLx>44) AGN decreases by a factor of ~10 from z=3 to 5. Heavily absorbed (logNH 23) AGN represent the ~50% of the overall population. I will then show preliminary results from the spectral analysis of some high-redshift, heavily-obscured AGN using new X-ray data from the on-going 7 Ms CDFS survey (PI: W. Brandt). Finally, I will present another on-going project, which regards the stacking of X-ray emission from high-redshift (up to z~10) AGN/galaxy candidates selected as Lyman Break Galaxies and Lyman Alpha Emitters in deep X-ray surveys.

2.29 Formation of discs around Supermassive black hole binaries

Felipe Garrido Goicovic (Instituto de Astrofísica, PUC)

Supermassive black holes are ubiquitous in galactic nuclei, and binaries of these massive objects are an inevitable product of the hierarchical evolution of structures in the universe. After a major merger it is expected an abundance of gas funneled to the center of the remnant, where it can drive the evolution of the binary and produce electromagnetic signatures, but how the gas interacts with the binary as it reaches its influence radius is still unclear. If the interstellar medium is turbulent and gravitationally unstable, an efficient mechanism to fuel the galactic nuclei with gas is through the formation of clumps. In this context, we model numerically the evolution of turbulent molecular clouds in near-radial infall onto equal-mass supermassive black hole binaries, using a modified version of the SPH code GADGET-3. As we expect the clouds to approach the binary from different directions, we investigate the different gas structures formed depending on the impact parameter and the relative inclination between the binary and the cloud orbits, and speculate electromagnetic signatures that we could get from them.

2.30 Non-active galaxies hosting Super-Massive Black Holes

Fernando J. Romero-Cruz (Universidad de Guanajuato)

We used a sample of 16733 galaxies from the SDSS DR7 in which there is no detection of any of the emission lines usually considered to discriminate between AGN and star formation activity (Baldwin et

al. 1981 and Veilleux et al. 1987). By applying the STARLIGHT code (Cid Fernández et al. 2005) we measured their velocity dispersion (sigma) and their Star Formation History (SFH). The average sigma is 300 km/s which according to the M_BH-sigma relationship would imply that these galaxies host a Super-Massive Black Hole (SMBH). Also, using the correlation between morphology and K-corrected photometric colours (u-g, g-r, r-i and i-z as defined in the SDSS photometric system) and between morphology and the inverse concentration index R50(r)/R90(r) (defined as the ratio of the 50% and 90% Petrosian radii) we inferred the morphology of these galaxies finding that they are predominantly early types.
From the SFH we found that the average age of the stellar population is approximately 10^10 years which is consistent with the ages of local early type galaxies. We suggest that the non activity may represent a relatively brief phase in the evolution of the AGN or that the reservoir of accreting material has been exhausted.

Group 3

3.31 A remarkably flat relationship between AGN luminosity and the average SFR of X-ray selected AGN

Flora Stanley (Durham University)

One of the outstanding problems in galaxy evolution is understanding how star formation (SF) relates to AGN activity. Using SED fitting to MIR-FIR photometry, that includes deblended Herschel photometry, we have decomposed the AGN and SF contributions and constrained the SFR values of over 2000 X-ray selected AGN from the fields of GOODS-N, GOODS-S, and COSMOS, within the redshift range of z = 0.2 -- 2.5. We have carefully folded in information from both direct measurements and upper limits to measure the average SFR with respect to AGN luminosity, and redshift, to a higher precision than any previous studies of distant AGN. Our results show remarkably little dependence of the SFR as a function of AGN luminosity. To understand this result and what it can tell us about the connection between AGN activity and SF, we compare to the predictions of the empirical models of Hickox+14, Aird+13, and the EAGLE cosmological hydrodynamical simulation. We find that the Eddington Ratio distribution applied in the empirical models can have a great effect on the predicted trends of SFR with AGN luminosity, suggesting that our results can be used as a constraint on the Edd. Ratio distribution. We have obtained ALMA observations for a subsample of our sources and find that not only it significantly improves our methods of constraining the AGN and SF emission in the FIR, it also allows the measurement of up to a factor ~7 lower SFRs.

3.32 TBD

Giorgio Lanzuisi (INAF OA-Bologna)

3.33 Galaxy vivisection: the intimate black hole-bulge connection revealed by accurate multicomponent decompositions

Giulia A.D. Savorgnan (Swinburne University (Melbourne))

Black hole mass scaling relations in the local Universe reveal the coevolution of galaxies and black holes, and set the boundary conditions (at z = 0) for theoretical models and simulations to better understand this symbiosis. A careful galaxy decomposition is required to accurately measure these galaxy/bulge properties. Recent studies have performed galaxy decompositions (with 1D or 2D parametric techniques), but they have not converged to the same conclusions. This is because their best fit models for the same galaxy were often signifi cantly different and not consistent with each other in terms of fitted components. Moreover, none of these studies has attempted an individual galaxy-by-galaxy comparison of their models with the previous literature. We have now made this comparison, identifi ed the optimal decomposition, and obtained improved black hole mass scaling relations using a large sample of # 70 galaxies. We independently perform 1D and 2D galaxy decompositions. Thanks to a careful inspection of the galaxy photometry (through isophotal analysis and unsharp masking) and - for the first time - of the kinematics, we are able to identify and model bulges, large scale discs, embedded or nuclear discs, spiral arms, bars, rings, halos, extended or unresolved nuclear sources and partially depleted cores. We con firm that S#ersic and core-S#ersic galaxies follow different trends and therefore are associated to different evolutionary scenarios.

3.34 Mapping a possible jet-cloud interaction in radio galaxy Pictor A

Guilherme dos Santos Couto (Universidade Federal do Rio Grande do Sul (UFRGS))

We present a two-dimensional analysis of the gaseous excitation and kinematics of the inner 2.5 kpc x 3.4 kpc of the broad-line radio galaxy Pictor A, from optical spectra obtained withe GMOS integral field spectrograph on the Gemini South telescope. Emission-line flux maps show an elongation in a bar-like structure close to the large scaled (> 200 kpc) radio jet of the galaxy, extending from the northeast to the southwest and crossing the nucleus. Gas excitation is low and suggests that are associated with the radio jet. The gas density is lowest along the elongated structure and highest in the nucleus and regions to the north from the nucleus. Centroid velocity maps suggest rotation is present, but somewhat distorted, almost perpendicular to the radio jet. Also blueshifted velocities are observed west from the nucleus, and seems correlated with the near side of the radio jet, which is only observed in one side in X-ray emission maps. Channel maps show a small amplitude of rotation (~ 150 km/s). The elongated structure appears both blueshifted and redshifted, suggesting it is close to the plane of the sky. Although this work is still in progress, results point to an interaction of the radio jet with the circumnuclear gas, being the main source of its excitation and distorting its rotation.

3.35

Hai Fu (University of Iowa)

3.36 New constraints on X-ray background synthesis models

Ioannis Georgantopoulos (National Observatory of Athens)

We discuss the new constraints on X-ray background (XRB) synthesis models. The constraints on XRB models arise primarily from the number counts in several X-ray bands ad secondarily from the spectrum of the XRB itself. We compare our XRB model (Akylas et al. 2012) with recent results on the number of Compton-thick objects in the 2-10 keV band by Brightman et al. (2014), the NUSTAR results in the 10-40 keV band as well our own analysis of the 70-month catalog SWIFT/BAT AGN.
We also present a comparison with the XRB synthesis models of Gilli, Treister, Ballantyne and Ueda and we finally discuss with the new constraints that arise on the fraction of heavily obscured AGN.

3.37 Mapping AGN accretion in the SFR-M* plane up to z~2.5

Ivan Delvecchio ((1) University of Zagreb, Physics Department, (2) University of Bologna, Department of Physics and Astronomy)

We study the relation of AGN accretion, star formation rate (SFR), and stellar mass (M*) using a sample of about 8600 star-forming galaxies up to z=2.5 selected with Herschel imaging in the GOODS and COSMOS fields. For each of them we derive SFR and M*, both corrected for possible emission from an active galactic nucleus (AGN), through the decomposition of their spectral energy distributions (SEDs). About 10 per cent of the sample are detected individually in Chandra observations of the fields. For the rest of the sample we stack the X-ray maps to get average X-ray properties. After subtracting the X-ray luminosity expected from star formation and correcting for nuclear obscuration, we derive the average AGN accretion rate for both detected sources and stacks, as a function of M*, SFR and redshift. The average accretion rate correlates with SFR and with M*. The dependence on SFR becomes progressively more significant at $z>0.8$. This may suggest that SFR is the original driver of these correlations. We find that average AGN accretion and star formation increase in a similar fashion with offset from the star-forming "main-sequence". Our interpretation is that AGN accretion and galaxy star formation broadly trace each other, irrespective of whether the galaxy is evolving steadily on the main-sequence or starbursting.

3.38 Resolving the effect of AGN on their host galaxies

James Allen (University of Sydney)

Many indirect lines of evidence suggest that AGN act to regulate star formation, resulting in the observed stellar mass distribution of high-mass galaxies and the tight relationship between black hole mass and bulge mass. However, direct evidence for AGN feedback effects on galaxy scales have been difficult to obtain. One limiting factor has been that multi-object spectroscopic surveys, while excellent for identifying large samples of AGN, are often unable to disentangle the AGN and galaxy properties. Integral field spectroscopy (IFS) overcomes this limitation by obtaining spatially resolved data for the whole galaxy, but until recently the sample sizes available have been very small. The new wave of large-scale IFS surveys, including the Sydney-AAO Multi-object Integral field spectrograph (SAMI) Galaxy Survey, are combining the benefits of each approach. The SAMI Galaxy Survey has now observed over 1000 galaxies, making it the largest survey of this type to date. For each AGN in the sample, we can measure the spatially resolved properties of the host galaxy, including the

distribution of ongoing star formation and any variations in star formation history. Crucially, the survey allows us to describe AGN within the context of the general galaxy population. By comparing the properties of AGN in the SAMI Galaxy Survey to a matched sample of non-AGN, we are able to directly measure the immediate influence of an AGN on its host galaxy. I will present initial results from this analysis, and show how the completed SAMI Galaxy Survey of ~3400 galaxies will allow further progress.

3.39 The ongoing hunt for supermassive black hole binaries

Jessie Runnoe (The Pennsylvania State University)

Supermassive black hole binaries (SBHBs) are thought to be a natural, if not inevitable, phase in scenarios in which most massive galaxies host central black holes and undergo frequent mergers as they evolve. While there are convincing examples of kiloparsec-separation pairs, there is currently no robust evidence for the close, sub-parsec binaries that are expected to exist. The detection of this population would contribute important evidence in favor of the prevailing galaxy evolution scenarios, and is also of interest in other fields including gravitational wave astronomy. We have undertaken a systematic search for close SBHBs based on the hypothesis that the secondary black hole in the binary accretes at a much higher rate than the primary, and its emission lines are doppler shifted due to its orbital motion (analogous to a single-line spectroscopic binary). Our sample of 88 candidates is therefore selected from $z<0.7$ SDSS quasars via substantial (>1000 km/s) shifts of their broad H-beta lines relative to their systemic redshifts. I will present an update on our efforts to evaluate the credentials of the candidates, including new radial velocity measurements from the spectroscopic monitoring program, a comparison of the spectral variability of the binary candidates to the broader quasar population, and a search for signs of recent merger activity in the host galaxies of the binary candidates.

3.40 Near IR Properties of NuSTAR hard X-ray Emitters Observed by Spitzer

Alejandra Melo (Universidad de Concepción)

In spite of significant progress, there are important open questions still unanswered in our understanding of the connection between the growth of supermassive black holes (SMBH) and galaxy evolution. In order to address these questions it is critical to characterize the multiwavelength properties of the host galaxies of Active Galactic Nuclei, the sites of intense SMBH growth using unbiased samples. The recently-launched NuSTAR hard X-ray observatory, thanks to its superb sensitivity at E~20 keV, provides the oportunity of obtain such unbiased AGN sample, as observations at these energies are not significantly affected by obscuration. In this poster we will present the observed-frame near-IR properties measured by Spitzer of the NuSTAR hard X-ray sources detected as part of the serendipitous survey, currently the widest and deepest extragalactic survey being carried out by NuSTAR. Specifically, I will present flux measurements at 3.6 and 4.5 microns for ~100 X-ray emitters. With these data, combined with others available for these sources, we will construct their spectral energy distribution. This will we used, among others, to measure stellar masses for the host galaxies of these NuSTAR-selected AGN, which are typically moderate-luminosity obscured AGN at z~0.3-0.7. These stellar mass measurements are fundamental in our understanding of the connection between galaxy evolution and SMBH growth.

3.41 DIVING 3D - Deep IFS View of Nuclei of Galaxies.

Joao Evangelista Steiner (IAG-USP)

Galactic nuclei are special regions of galaxies, hosting supermassive black holes and stellar populations that record important aspects of the history of the galaxy formation and evolution. We will present the DIVING3D project, an IFU/GMOS survey of a complete sample of 170 galaxies in the southern hemisphere with B<12.0, δ<0˚ and |b|>15˚. Telescope time has been approved in the context of the Brazilian LLP (Long and Large Projects) Program.
We expect to achieve 4 scientific goals:
a- Nuclear emission line properties. Detect and study the statistical, geometric and physical properties of Low Luminosity AGN: “dwarf” Seyferts and LINERs as well as starburst nuclei.
b- Circumnuclear emission line properties. Determine the nature and ionization mechanism as well as the kinematics of the line emitting gas in the ~100 pc scale circumnuclear region.
c-Stellar kinematical properties of all nuclei. Mass-to-light ratios will be derived on dynamical basis and compared to those of spectral synthesis and stellar velocity.
d-Stellar populations archeology. Study the chemical composition and history of star formation using state-of the-art methods and stellar population models.
Preliminary results will be presented for the subsample of massive (sigma>200km/s) galaxies.

3.42 Angular momentum transport in the first galactic discs.

Joaquín Prieto (DAS U. de Chile)

3.43 Obscuration-dependent evolution of Active Galactic Nuclei

Johannes Buchner (Max-Planck-Institut für extraterrestrische Physik)

A robust determination of fraction of obscured and Compton-thick AGN is a long-standing issue in AGN research. We address this problem using a multi-tiered survey of 2000 X-ray hard-band detected AGN with redshifts in the range z=0.5-4. The X-ray spectrum of each source is analysed using a Bayesian fitting technique capable of handling the low X-ray counts, errors in the optical identification of X-ray sources and uncertainties in photometric redshift determination. This yields luminosities in the interval L=10^42-46 erg/s and column densities that extend into the Compton thick regime, N_H=10^20-26 cm^-2. I will present a new non-parametric method that uses the above data to infer the space density of AGN as a function of luminosity, obscuration and redshift. We find the fraction of Compton-thick AGN to be 36%(+-8) averaged over cosmic time, while obscured (N_H>10^22 cm^-2) AGN represent 75%(+-4) of the total population. These fractions evolve with cosmic time, as AGN of different obscurations show distinct evolutionary patterns, with AGN around NH~1e23 cm^-2 evolving the fastest. We study the luminosity dependence of the fraction of obscured and Compton-thick AGN in detail, and find that this relationship evolves over cosmic time.
Physically motivated models that can explain the observed trends will also be discussed.

3.44 Examining the Black Holes in Compact, High-dispersion Galaxies though AO Observations

Jonelle Walsh (Texas A&M University)

Correlations between black hole (BH) masses and galaxy bulge properties have been clearly established over the past 15 years. However, major questions remain, particularly concerning the sparsely populated upper end of the BH mass distribution. Through a large survey with the Hobby Eberly Telescope (HET), we have identified a sample of dense, rapidly rotating, early-type galaxies, with small sizes and high stellar velocity dispersions for their luminosities. The HET spectra hint that these compact, high-dispersion galaxies could host some of the largest BHs known, and that the BHs could weigh a surprisingly high fraction of its host galaxy's mass. The galaxies are very different from the objects typically found at the upper end of the BH mass - bulge relationships, but appear similar to the z~2 quiescent galaxies. I will present new observations of the nuclear stellar kinematics for six compact, high-dispersion galaxies made using the integral field spectrographs on the Gemini and Keck telescopes assisted by adaptive optics. By combining with large-scale kinematics and imaging observations, we construct orbit based stellar dynamical models. I will discuss the dynamical modeling results for two galaxies, including constraints on the BH masses and their location on the BH mass - galaxy relationships.

3.45 AGN activity in Balmer Break Galaxies at z < 1.0

Jorge Díaz Tello (Universidad Autónoma de México)

We present a spectroscopic study with the derivation of the physical properties of 37 Balmer break galaxies, which have the necessary lines to locate them in star-forming–active galactic nuclei (AGNs) diagnostic diagrams.
These galaxies span a redshift range from 0.045 to 0.93 and are somewhat less massive than similar samples of previous works. The studied sample has multiwavelength photometric data coverage from the ultraviolet to mid-infrared (MIR) Spitzer bands. We investigate the connection between star formation and AGN activity via optical, mass-excitation (MEx), and MIR diagnostic diagrams. Through optical diagrams, 31 (84%) star-forming galaxies, two (5%) composite galaxies, and three (8%) AGNs were classified, whereas from the MEx diagram only one galaxy was classified as AGN. A total of 19 galaxies have photometry available in all the IRAC/Spitzer bands. Of these, three AGN candidates were not classified as AGN in the optical diagrams, suggesting they are dusty/obscured AGNs, or that nuclear star formation has diluted their contributions.

Group 4

4.46 Study of the interacting starburst galaxy AM1219-430

Jose Hernandez-Jimenez (Instituto de Fisica-Universidade Federal Rio Grande do Sul)

Models of galaxy encounters predict that galaxy-galaxy interactions make the gas deviate from its original motion, inducing gas flow towards the galaxy center via gravitational torque. We present Gemini-South GMOS/IFU observations of the main galaxy of the minor merger AM1219-430 to investigate the nuclear region and circum-nuclear HII regions complexes. Mapping the radial and

dispersion velocities of the ionized gas and stars, we determined if there is radial streaming motion of the gas to the center. We use diagnostic diagram of the ionization line ratios in order to determine the structure of the high and low ionized gas, and the ionization mechanism.

4.47 AGN-Host Galaxy Connection: An Interstellar Medium Perspective

Jose Utreras (Universidad de Chile)

4.48 SERVing Up Clustering Around Obscured and Unobscured Quasars at z~2

Kristen M Jones (University of Virginia)

We investigate the Mpc-scale environments of quasars at z~1-3 using the Spitzer Extragalactic Representative Volume Survey (SERVS) . We compare optically obscured quasars to a control sample of optically-bright quasars of similar bolometric luminosity and redshift using estimates of the quasar/galaxy correlation function. Recent work has found diverse results in such studies, with Donoso+2014 observing richer environments for WISE selected quasars than optical selected ones, but Allevato+2014 observing poorer environments for obscured X-ray selected quasars. We explore the effects of redshift, selection criteria, and survey choice, and we compare these recent studies, along with our own results, to earlier work. Finally, we explore the implications of these results with respect to galaxy evolution, especially concerning the formation of massive halos in the era when quasars dominated the luminosity of the universe.

4.49 Black Hole Masses of Narrow Line Seyfert 1s at 0.2 < z < 0.4

Kyle D Hiner (Universidad de Concepción)

Recent efforts to measure the evolution of the black hole - host galaxy scaling relations have hinted that black hole growth predates that of the host galaxy, but there remain many open questions and caveats. For example, previous investigations into the non-local MBH-σ relation examined objects with MBH > 108 M⦿. While the results of these investigations showed those black holes to be over-massive compared to their host galaxies, the possibility that the samples were biased has not been ruled out. The entire lower-mass regime (MBH < 10^8 M⦿) has not been examined in the non-local universe. We have selected a sample of Narrow-Line Seyfert 1 galaxies in the redshift range 0.2 < z < 0.4 in order to study the non-local MBH-σ relation. These galaxies show broad lines in the range 500 - 2000 km/s, and therefore we expect them to have black hole masses lower than the previous samples. We will thereby address the caveat of sample bias in previous studies, and increase the number statistics in the study of the non-local MBH-σ relation. In this presentation, I will exhibit spectroscopy of the sample from the Magellan Baade Telescope and black hole mass calculations.

4.50 Jet Feedback on the Hosts of Radio Galaxies

Lauranne Lanz (IPAC/Caltech)

We present UV-FIR spectral energy distributions (SEDs) of radio galaxies whose jets are injecting energy and turbulence into their hosts' ISM. Feedback due to active galactic nuclei is one of the key components of the current paradigm of galaxy evolution; however our understanding of the process remains incomplete. Radio galaxies with strong rotational H2 emission provide an interesting window

into the effect of radio jet feedback on their host galaxies, since the large masses of warm (>100 K) H2 cannot solely be heated by star formation, instead requiring jet-driven ISM turbulence to power the molecular emission. Our recent work on two such galaxies, 3C293 and NGC4258, has also raised questions regarding the appropriate X_CO factor for this type of galaxy. I will discuss the insights the SEDs of a sample of such radio galaxies yield on the impact of jet feedback on the star formation, gas, and dust properties of the host galaxy. In particular, I will address whether jet feedback in these galaxies tends to suppress star formation, whether heated molecular gas is associated with warmer dust, and whether the peculiarities of the gas-to-dust ratio of 3C293 and NGC4258 are common to radio galaxies with warm H2.

4.51 The Search for Active Black Holes in Local Dwarf Galaxies Using Optical and MID-IR Data

Lia Federica Sartori (ETH Zurich)

The study of AGN in the low-mass regime is important in order to understand BH formation and evolution, as well as their connection with their host galaxies. Starting from a sample of ∼ 48000 nearby low-mass galaxies (M* ≤ 10^9.5M⊙, z < 0.1) in the SDSS, we searched for galaxies exhibiting AGN signatures applying optical emission lines diagnostics and mid-IR color criteria. The observed AGN fraction, ∼ 0.7%, seems to be at least one order of magnitude below what found for more massive objects. This fraction is too low to constrain the total BH occupation fraction at low mass regime. The AGN candidates selected by the different selection criteria show different physical properties, which could indicate that they are different in physical nature. Archival X-ray and radio data available for some of the optically selected AGN candidates confirm their AGN nature, but follow-up observations are needed to confirm the AGN nature of the mid-IR selected candidates. In addition, part of the AGN candidates sample shows an unexpected deficit of mid-IR emission, which could be due to a dust deficit and the partial absence of an obscuring torus. If confirmed, this may lead to new insights into the AGN central engine structure in the low-mass regime.

4.52 Coevolution of Black Holes and their Host Galaxies in Cosmological Simulations

Lisa K. Bachmann (Universitäts-Sternwarte München)

Large scale cosmological hydrodynamic simulations are a valuable tool for a better understanding of relations between black holes, their host galaxies and the link between galaxy formation, star formation and AGN activity. The set of Magneticum Pathfinder simulations, which is based on a state-of-the-art TreePM-SPH implementation in P-GADGET3, allows to study this coevolution in high resolution, extremely large cosmological simulations. The detailed treatment of the underlying physical processes is one of the most advanced schemes, following a wide range of physical processes. Our most recent simulations include a detailed description of AGN feedback motivated by theory and observations, eliminating most free parameters. It covers radio-mode and quasar-mode AGN feedback and is efficient in suppressing black hole growth and star formation in the most massive galaxies. The youngest generation of cosmological simulations can resolve the internal structure of galaxies allowing us to distinguish between different galaxy types while still having a large sample of AGN. In these simulations we can trace galaxies and their central black holes back in time and investigate how most luminous AGN are triggered. Simulations provide us with several properties which are difficult to observe, e.g. the total mass of dark matter haloes and the environment of galaxies and AGN. Since

simulations cover a large range of black hole masses and luminosities, we can study the relation between black holes and the underlying dark matter potential of galaxies and their clustering properties. Thereby we investigate selection effects present in observations onto the interpretation of AGN clustering measurements.

4.53 On the variable nature of LLAGN

Lorena Hernández García (Instituto de Astrofísica de Andalucía (IAA-CSIC))

Although variability is a general property of active galactic nuclei (AGN), and in the particular case of low luminosity AGN (LLAGN) variations have been found for some objects, the way in which these changes occur at X-rays is still debated.
The main purpose of this work is to investigate the X-ray variability in LLAGN, including the main driver of these variations, and to compare how the changes occur in different kinds of objects.
We examined a sample of 18 LINERs and 27 type 2 Seyferts with data retrieved from the Chandra and/or XMM-Newton archives that correspond to observations gathered at different epochs. All the spectra for the same object were fitted simultaneously to study long-term variations. The nature of the variability patterns were studied by allowing different parameters to vary during the spectral fit. Whenever possible, short-term variations from the analysis of the light curves and long-term UV variability were studied.
Variability in LINERs appears as a common property regardless of the optical type1/type2 classification. The origin of the variability is due to changes in the nuclear power. Only one out the 18 LINERs shows changes in absorptions. These results have been already published (Hernández-García et al. 2014).
Preliminary analysis of type 2 Seyferts shows a larger mixture of properties. Some of them show similar variability to that found in LINERs, i.e., variations due to the energy power but variations due to absorption appears also as a common property. Implications for current accretion models will be discussed.

4.54 Quasars Probing Quasars: the Cool Circumgalactic Medium Surrounding z~2 Massive Galaxies

Marie Wingyee Lau (University of California, Santa Cruz)

Galaxies hosting z ∼ 2 quasars are the progenitors of today’s massive red and dead galaxies. With close pairs of quasars at different redshifts, a background quasar can be used to study a foreground quasar’s halo gas in absorption, providing information about feedback, quenching, and the physics of massive galaxy formation. I will present 14 high resolution spectra of bright background quasars in projected pairs with separations < 300 kpc at the redshift of the foreground quasars. These systems reveal high incidence of optically thick absorbers coincident with the foreground quasar redshifts, extreme kinematics with metal absorption lines spanning ∼ 300 km s^−1, and enrichment approaching solar. Furthermore there is evidence that the illumination on gas by the foreground quasars is anisotropic or intermittent.

4.55 What makes radio-AGN tick? Triggering and feeding of active galaxies with strong radio jets

Marios Karouzos (Seoul National University)

While the link between activity in the nuclei of galaxy and galactic mergers has been under scrutiny for several years, it is still unclear to what extent and for which populations of active galaxies merger-triggered activity is relevant. The environment of AGN allows an indirect probe of the past merger history and future merger probability of these systems, suffering less from sensitivity issues while extending to higher redshifts, compared to traditional morphological studies of AGN host galaxies. Here we present results from our investigation of the environment of radio selected sources out to redshift z=2. We employ the first data release J-band catalog of the new near-IR Infrared Medium-Deep Survey (IMS) and 1.4 GHz radio data from the Faint Images of the Radio Sky at Twenty-cm (FIRST) survey and a deep dedicated VLA survey of the VIMOS field, covering a combined total of ~20 sq. degrees. At a flux limit of the combined radio catalog of 0.1 mJy, we probe over 8 orders of magnitude of radio luminosity. Using the second and fifth closest neighbor density parameters, we test whether active galaxies inhabit denser environments and study these overdensities in terms of both distance to the AGN and its luminosity. We find evidence for a sub-population of radio-selected AGN that reside in significantly overdense environments at small scales, although we do not find significant overdensities for the bulk of our sample. We do not recover any dependence between the AGN radio-luminosity and overdensities. We show that radio-AGN inhabiting the most underdense environments have vigorous ongoing star formation, high accretion rates, and powerful radio jets. We interpret these results in terms of the triggering and fuelling mechanism of radio-AGN.

4.56 Obtaining the AGN dust covering factor from the ratio of mid-IR to optical-UV luminosity: difficulties and how to overcome them

Marko Stalevski (Universidad de Chile)

Understanding the relation between the supermassive black hole and its close environment is a fundamental step to comprehend how Active Galactic Nuclei (AGN) and their host galaxies interact. To do so it is very important to obtain a reliable method to estimate the covering factor of the circumnuclear material. The ratio of re-processed mid-IR emission to intrinsic nuclear bolometric luminosity has been commonly used in the past years as a proxy of the amount and covering factor of the molecular dusty torus. The dust covering factors obtained in such way are often used to infer fraction of obscured AGNs as a function of luminosity and redshift and thus have an important role in studying AGN evolution and extending the standard orientation-dependent unification model. In this work we are concerned with the question of how reliable is the ratio of mid-IR to optical-UV bolometric luminosity as an estimator of the dust covering factor. By means of Monte Carlo radiative transfer simulations we calculated a grid of the dusty tori spectral energy distributions for a range of bolometric luminosities and opening angles. We compared the true covering factors with the ones obtained from the luminosity ratios. From our analysis, we find that relation between the covering factor and luminosity ratio is far from simple, namely due to intrinsically anisotropic emission of both the accretion disk and the dusty torus, but moreover due to complex interplay of the dusty torus properties and radiative transfer effects. We discuss the difficulties in obtaining the true dust covering factors and provide guidelines for applying needed corrections.

4.57 Modeling AGN Radio-Mode Feedback in Cosmological Simulations

Rainer Weinberger (Heidelberg Institute for Theoretical Studies (HITS))

Current simulations of galaxy cluster formation have difficulties in simultaneously reproducing the observed star formation rate, temperature structure and gas content of galaxy clusters. One possible reason for this apparent failure is the inadequate treatment of the unresolved physics close to supermassive black holes. In particular, the simplistic estimate of the accretion rates as well as the modeling of the energy injection from jets from active galactic nuclei (AGNs) into the surrounding gas leads to unnatural behavior on small scales in these simulations.
We will present a new treatment of the radio-mode feedback from AGNs taking into account recent observational and theoretical findings, implemented into the moving-mesh code AREPO, which has proven to be an excellent tool for cosmological simulations of galaxy and galaxy cluster formation. We will present first results from idealized tests as well as the effect of AGN feedback on the intra-cluster medium in cosmological zoom simulations of galaxy clusters of different masses.

4.58 A cosmological simulation of AGN growth at high resolution

Ricarda Beckmann (University of Oxford)

This poster will shed new light on how AGN accrete material when simulated at previously unattained resolutions in a cosmological setting. It will track gas flows over a wide variety of scales, from the intergalactic medium down to a fraction of a parsec in the vicinity of the black hole. It is bases on a simulation using RAMSES, a particle-mesh AMR code.

4.59 An off-centered active galactic nucleus in NGC 3115

Roberto Bertoldo Menezes (Instituto de Astronomia, Geofísica e Ciências Atmosféricas - Universidade de São Paulo)

NGC 3115 is an S0 galaxy that has always been considered to have a pure absorption-line spectrum. Some recent studies have detected a compact radio-emitting nucleus in this object, coinciding with the photometric center and with a candidate for the X-ray nucleus. This is evidence of the existence of a low-luminosity active galactic nucleus (AGN) in the galaxy, although no emission line has ever been observed. In this work, we analyze a data cube of the nuclear region of NGC 3115, obtained with the GMOS-IFU, and report the detection of an emission-line spectrum of a type 1 AGN in this galaxy, with an Halpha luminosity of L_Halpha= (4.2 +\- 0.4) x 10^37 erg/s. Our analysis revealed that this AGN is located at a projected distance of ~0.29” +\- 0.05” (corresponding to ~14.3 +\- 2.5 pc) from the stellar bulge center, which is coincident with the kinematic center of this object's stellar velocity map. The black hole corresponding to the observed off-centered AGN may form a binary system with a black hole located at the stellar bulge center. However, it is also possible that the displaced black hole is the merged remnant of the binary system coalescence, after the “kick” caused by the asymmetric emission of gravitational waves. We propose that certain features in the stellar velocity dispersion map are the result of perturbations caused by the off-centered AGN.

4.60 Feeding vs. Feedbach in AGNs probed with Near-IR Integral Field Spectroscopy

Rogemar A. Riffel

We have been observing Active Galactic Nuclei (AGN) using near-infrared (Near-IR) integral field spectroscopy (IFS) for about 10 years. Most of these observations were done with the Gemini's Near-IR Integral Field Spectrograph (NIFS) with adaptive optics at spatial resolutions of tens of parsecs and covering the inner few hundreds of parsecs of the galaxies. So far, we were able to map mass inflow and outflow rates, the ages of the stellar populations and the flux distributions for ionized and molecular emission lines of about a dozen of galaxies. One of the main result is that the molecular and ionized gas have distinct flux distributions and kinematics, with the former being more restricted to the plane of the galaxy - showing inflows in some cases, and the latter extends to high latitudes above the galaxy plane, attributed to emission of gas in outflows from the nucleus. In this work we show a summary of the project, as well as results for galaxies recently observed.

Group 5

5.61 Supermassive Black Holes in Composite Bulges

Ronald Läsker (MPIA)

We present results from a deep HST/WFC3 survey of Supermassive Black Hole (BH) host galaxies in which the BH mass was precisely determined from nuclear Megamaser emission. Based on this data, we performed detailed decompositions, detecting and parametrizing, amongst others, nuclear components and pseudobulges. In almost all our targets we find and separately model a (usually small) classical morphological bulge in coexistence with late-type central morphological features (nuclear or small-scale disks, bars, rings, and X-shaped bulges). After modeling the stellar mass based on stellar population synthesis, we show that the extracted classical bulge masses in these and other late-type, pseudobulge host galaxies broadly follow the same BH-stellar mass relation as early-type systems do. At face-value these results confirm and strengthen the case for AGN feedback and a co-evolution of BHs and galaxy spheroids. However, we also find an increase of intrinsic scatter towards low masses, and that inclusion of pseudobulge components or even the large-scale disk leads to a similar correlation behavior. I will discuss possible implications of these results and give an outlook on future work to answer remaining questions.

5.62 Kinematic Studies of Stellar, Atomic and Molecular Gas in Nearby Mergers and AGNs

Roy Slater (University of Concepción)

5.63 Quenching and Bulge Growth by Mergers and Disk Instabilities in CANDELS and in Semi-Analytic Models

Ryan Brennan (Rutgers University)

The mechanisms by which galaxies are transformed over time, both in terms of their star formation rates and their morphologies, are still not clearly known. We examine the buildup of the quiescent and spheroid-dominated fractions of galaxies from the CANDELS and GAMA surveys from z~3 to the present and compare these fractions with those derived from the Santa Cruz semi-analytic model, which includes prescriptions for bulge growth and AGN feedback due to mergers and disk instabilities. We then subdivide our population into four types: star forming disk-dominated, star forming spheroid-dominated, quiescent disk-dominated and quiescent spheroid-dominated. We examine the evolution of the fraction of galaxies in each of these populations with redshift for both the models and the observations. Using the models, we determine which processes are most important for building up these populations. We find that the simple picture of disk galaxies merging, undergoing AGN feedback and forming massive, quiescent elliptical galaxies is in many cases too simplistic; most galaxies undergo several transformational events, with mergers, disk instabilities and new gas accretion all working together.

5.64 Post-starburst Quasars: Snapshots of AGN in Transition

Sabrina Lyn Cales (Yale University, Universidad de Concepcion)

Our understanding of the link between galaxies and the active galactic nuclei (AGN) they host is crucial for our understanding of galaxy evolution, a major question for astronomy today. As such, galaxies that harbor both luminous, broad-lined AGN phenomenon and massive, post-starburst stellar populations (post- starburst quasars, PSQs) provide a natural laboratory for those studying AGN, galaxies and galaxy evolution alike. PSQs are predicted to be transitioning galaxies whereby both the AGN and post-starburst phenomenon exist simultaneously. PSQs may in fact be transitioning into, or out of, a higher luminosity phase, in which the post-starburst is easily hidden in the glare of a more extreme quasar, but easily selected in the transition. Thus studying these objects can prove invaluable for understanding connections between nuclear activity and host galaxy evolution. We present the latest work on the study of PSQs and their role in mutual black hole and galaxy evolution. In particular we present several interesting cases of PSQs with variable AGN contribution.

5.65 Numerical Models of AGN Jet Feedback

Salvatore Cielo (Max Planck Institute for Astronomy)

We perform and analyze 3D detailed hydrodynamical simulations of jets from Active Galactic Nuclei interacting with a hot galactic halo environment. The aim of our simulations is to study the heating mechanisms at the heart of current sub-grid implementations of AGN feedback in semi-analytical models and cosmological simulations.
We focus on the jet-gas energy coupling and on the volume fraction of heated gas, distinguishing between the contribution from pressure waves and from the large hot bubbles inflated by the jets. Our findings show that while AGN jets might have significant energy coupling, they (except in the most

powerful, but rare, cases) seem to lack the required volume coverage to halt gas cooling onto the central galaxy on cosmological timescales (> 100 Myr).
Indeed, strong central cooling reprises shortly after each jet event, as it is also visible in synthetic X-ray observations generated from the simulation outputs.This low volume coverage might challenge the generally accepted picture according to which AGN feedback is able to quench star formation in massive halos.

5.66 SMG-QSO multiple system revealed by LABOCA at z=4.46

Sam Kim (Pontificia Universidad Catolica de Chile)

5.67 Cosmologic evolution of supermassive black holes

Stephanie Dörschner (Institut für Astrophysik, Georg-August Universität Göttingen)

We investigate how well current models of the co-evolution of supermassive black holes in the centers of galaxies are able to reproduce the population of supermassive black holes and their host galaxies in cosmological context. We use Galacticus, a semi-analytic model of galaxy formation, to evolve approximately 10 000 galaxies residing in dark matter halos. Galacticus offers different models for the accretion and feedback mechanisms of the galaxies' central black holes with varying degrees of simplicity. In order to trace the cosmological merger history of the dark matter halos hosting the galaxies we apply dark matter halo merger trees from Monte-Carlo simulations as well as N-body simulations.
Our results show that simple accretion models such as the so-called Eddington accretion are not able to reproduce the observed HI gas mass fractions in the galactic disks or the cosmic history of star formation. In contrast, more complex models as a combined ADAF-Shakura-Sunyaev accretion disk produce results in concordance with current observations. First comparisons also indicate that the results from Galacticus based on Monte-Carlo simulated merger trees significantly differ from results obtained with merger trees from N-body simulations, stressing the importance of using realistic halo parameters from cosmological simulations.

5.68 Unified, halo-mass-driven galaxy evolution model

Thales Gutcke (Max Planck Institute for Astronomy)

We employ a semi-analytic model to present a unified evolutionary picture for Active Galactic Nuclei (AGN) based on the correlation between dark-matter halo mass and AGN luminosity. We show how different AGN populations (radio galaxies, quasars, moderate luminosity X-ray AGN) evolve on this correlation though cosmic time and quantify the effect of galaxy mergers and secular process on triggering AGN activity. Our findings suggest a strong dependence of the AGN phenomenology on dark-matter halo mass, which ultimately implies a strong link to the cooling efficiency of hot gas in the universe.

5.69 Properties of the circumnuclear gas emission of a sample of 10 Early-type galaxies

Tiago Vecchi Ricci (IAG - University of Sao Paulo)

Many Early-type galaxies have ionized gas emission in their centres that extends to scales of ~ 1kpc. The majority of such objects are classified as LINERs, but the nature of their ionizing source is still not clear. The kinematics of these structures usually shows deviations from a pure rotational motion due to non-gravitational effects or to non-axisymmetric potentials. We present the analysis of the circumnuclear gas emission (scales of ~ 100 pc) of 10 early-type galaxies. Circumnuclear gas emission was detected in seven galaxies, all containing LINER-like spectra. Pure gaseous discs are found in three galaxies. In two objects, gaseous discs are probably present, but their kinematics are affected by non-Keplerian motions. In IC 5181 we detected a spiral structure of gas that may be caused either by a non-axysymmetric potential or by an outflow together with a gaseous disc. In NGC 3136, a bicone is present. We found that ionizing photons emitted by an AGN are not enough to explain the observed Hα flux along the gaseous discs. Along the perpendicular direction of this structure, the Hα flux distribution and equivalent width seem to be related with the nuclear activity. We propose a scenario for LINER-like circumnuclear regions where an ionization cone is formed by a collimating agent aligned with the gaseous disc.

5.70 Galaxy Evolution with Submm Proxies: Tests on ~3000 nearby galaxies in the 2MRS Sample

Valentina Peirano (Universidad de Concepción)

A galaxy's star formation rate and its stellar, gas, and dust masses, can be efficiently estimated via empirical scaling relationships which use continuum fluxes in the ultraviolet, infrared and sub-mm. Using all (3000) nearby galaxies in the 2MRS sample for which at least one sub-mm detection in the Planck all-sky survey (used as a proxy for molecular gas mass), we aimed to test the validity of different methods to compute SFR and gas mass. Also we derived stellar, gas, and gas to stellar mass functions, and determined the distributions of star formation rate(SFR), star formation efficiency (SFE), and specific star formation rate (sSFR). Constraining the factors, e.g. compactness, dust temperatures, morphologies, which determine the galaxies position on the SFR-M_star plane (main sequence vs. starbursting galaxies) and the SFR-M_gas plane (Schimdt-Kennicutt), we refine the slope of the z=0 main sequence (for different metallicities) and the Schmidt-Kennicutt Law (for normal star forming galaxies and starburst galaxies). Our results allow a better calibration of these scaling laws when applied to higher redshift samples.

5.71 Quasar ionization echoes - 100,000 years of AGN activity

Mischa Schirmer (Gemini South)

Green Bean galaxies feature ultra-luminous emission line regions around radio-quiet type-2 AGN. Extending over up to 100 kpc, they retain a memory of an AGN's activity over the last 100,000 years, and we work towards reconstructing the according light curves. This also opens a new window into SMBH accretion, galaxy evolution and AGN feed-back. In this poster I review the current status of our observations and the main reconstruction methodology.

5.72 The impact of AGN activity on star formation of their host galaxies

Mojegan Azadi (UC San Diego, Center for Astrophysics&Space Sciences)

I will present results on the host galaxy properties of X-ray AGN at z~0.7 and z~2.3, using spectroscopic information from the PRIMUS and MOSDEF surveys. We find a wide range of SFRs and stellar masses at a given Lx for both star-forming and quiescent host populations, and we do not find significant correlations between SFR or stellar mass and Lx. However, we show that AGN activity is more prevalent in star-forming galaxies compared to quiescent galaxies at the same stellar mass, suggesting an underlying connection between star formation and AGN activity. We further find that both star-forming and quiescent galaxies have AGN with a power law distribution of accretion rates, implying that a similar physical mechanism is fueling AGN in both galaxy populations.

5.73 AGN-Host Galaxy Connection: An Interstellar Medium Perspective

Mónica Silvia Taormina (Universidad de Concepción)

We present the first results of our optical spectroscopy for the new X-ray sources in the Chandra Deep Field South (CDFS). A total of 281 targets were observed using the VIMOS multiobject spectroscopy instrument mounted on the VLT telescope with the aim to provide their identifications and redshifts. The sample is the deepest one in this region thanks to the 4Msec Chandra data, which provided spectroscopic identifications for the faintest X-ray sources ever detected, including many obscured and unobscured AGN at $1.5 < z < 3$. This will let us set better limits on many statistical properties of these populations. We will show the distributions of the redshifts and the optical and X-ray luminosities of these objects, as well as the analysis of their colors, the clustering and the morphology of their host galaxies.

5.74 AGN evolution from a galaxy evolution viewpoint

Neven Caplar (Institute for Astronomy, ETH Zurich)

We explore the connections between the evolving galaxy and AGN populations. We present a simple phenomenological model that links the evolving galaxy mass function and the evolving quasar luminosity function, motivated by similarities between the two, which makes specific and testable predictions for the distribution of host galaxy masses for AGN of different luminosities. We show that the normalisations of the galaxy mass function and the AGN luminosity function closely track each other over a wide range of redshifts, implying a constant "duty cycle" of AGN activity. The strong

redshift evolution in the AGN break luminosity L^∗ is produced by either an evolution in the distribution of Eddington rations, or in the mbh/m_∗ mass ratio, or both. An evolving mass ratio, such that it is ten times higher at z∼2 (i.e. roughly following (1+z)^2), reproduces the observed distribution of SDSS quasars in the (m_bh,L) plane and accounts for the apparent "sub-Eddington boundary "without new physics and also satisfactorily reproduces the local relations which connect the black hole population with the host galaxies for both quenched and star-forming galaxies. The model produces the appearance of "downsizing" without any mass-dependence in the evolution of black hole growth rates (Eddington ratios) and enables a quantitative assessment of the strong biasses present in luminosity-selected AGN samples. The constant duty cycle is only consistent with the idea that AGN trigger the quenching of star-formation in galaxies if the lifetime of the AGN phase satisfies a particular mass and redshift dependence.

5.75 Metallicity determinations in AGNs based on optical narrow emission-lines

Oli Luiz Dors Junior (Universidade do Vale do Paraiba)

We use a sample of optical spectroscopy data of Active Galaxy Nuclei (AGNs) compiled from the literature and taken from the Sloan Digital Sky Survey Data Release Seven to calculated the metallicity by using a direct detection of the electron temperature (Te-method). We results show that a metallicity oversolar, generally attributed at AGNs, is not obtained when direct determination of the temperature is used. The average value derived for our sample is 1/5 of the solar metallicity.
An explication for the low metallicity in AGNs is that gas shock excitation increases the emission-line intensities and the electron temperature, yielding inaccurate values of this parameter when Te-method is used.

Group 6

6.76 Where is the starburst of SMM J04135?

Olimpia Fogasy (Chalmers University of Technology, Department of Earth and Space Sciences)

To understand the well-known correlation between the central super-massive black hole mass and the bulge mass, the study of gas- and dust-rich, starbursting high-z AGN host galaxies is crucial. In these AGN the starburst can be triggered by interaction and merger of gas-rich systems.
The submm-discovered type-1 quasar SMMJ04135 (z=2.84) is a very special system, which has one of the most massive molecular gas reservoirs (M[H2]~10^11 Msun) seen in the high-z universe. Recent CARMA observations revealed that this gas reservoir is spatially offset by 41.5 kpc from the AGN position and is associated with an optically faint, gas-rich companion galaxy. It has been suggested that the quasar and its companion galaxy could be a wet-dry merger, i.e., a gas-poor/gas-rich merger event. Such events are difficult to find, making this a rare case.
The first step to puzzle out this extraordinary system and determine the properties of the quasar host galaxy and the companion galaxy (e.g. star formation rate, molecular gas mass, kinematics etc.) is to constrain its spectral energy distribution. We here present the SED of SMMJ04135 and its companion using archive optical, IR and mm data. In the possession of the integrated SED we can get one step

closer to the understanding of the big picture, i.e. the correlation between the mass of the SMBH and the bulge, the evolution of high-z galaxies.

6.77

Patricia Bessiere

6.78 GMOS 3D Spectroscopy of the AGN environment in NGC 1566

Patricia da Silva (Geofísica e Ciências Atmosféricas (IAG-USP))

In this poster we will show the results of our work about the center of NGC 1566, a Seyfert 1 galaxy that has the same morphological type as the Milky Way: SAB(rs)bc. We have analyzed data cubes from the Gemini South Telescope collected with the IFU (Integral Field Unit) of GMOS (Gemini Multi-Object Spectrograph). We have performed a spectral synthesis in order to subtract the stellar continuum and analyze, in more detail, the emission lines of the data cube. The analysis with PCA Tomography reveals the gas kinematics around the AGN and the existence of high and low ionization regions in the field of view. The analysis of the gas kinematics shows that it may be consistent with an outflow or a rotating gaseous disk around the AGN. Finally, an analysis of the emission-line ratios (using a diagnostic diagram) reveals that the low ionization region is an HII region, whose position is consistent with molecular gas found in a recent study with ALMA data.

6.79 The effect of Mergers on the 'Main Sequence' of Star Formation

Paula Calderón Castillo (Universidad de Concepción)

Many studies indicate that merging systems show an increased star formation rate (SFR), and that this SFR varies across the merging stage (Hernquist 1989). It is also known that super-massive black holes (SMBH) at the center of their galaxies may initiate nuclear activity, and thus affect the star formation (Croton et al. 2006, Hopkins et al. 2006, Menci et al. 2006). It is often observed in galaxies containing an AGN, nuclear activity is a very good explanation for fast outflows. As this is often observed in galaxies containing an AGN, it is reasonable to assume that they are driven by nuclear activity. Nevertheless, the impact of AGN on the star formation in merger systems is still unclear. The BH growth evolves differently at different merging stages. Hence, it is critical to investigate mergers at different stages in order to study the distribution of atomic gas, star formation, and molecular gas, and test for the presence of inflows/outflows. This will allow us to relate star formation activity and merger stages, and how mergers evolve through the SFR-Mass plane.

6.80 SMBH formation and evolution in gas-rich high-z clumpy galaxies

Pawel Biernacki (University of Zurich)

6.81 SINFONI-AO Observations of z=1-2 ULIRGs

Valeria Olivares (Universidad de Concepción)

We seek to understand the origin of extremely high star formation rates of ∼1000 M yr−1 in sub-millimeter galaxies (SMGs) and ULIRGs at z∼2. Recent work (Champan 2008, Casey 2009) has demonstrated that at high redshift ULIRGs exist and contribute to the SFR

density at z∼2.
Using SINFONI and adaptive optics integral field spectroscopy of 5 galaxies, which were selected to have high-confidence spectroscopic redshifts, and they are in the redshift range 1.32 < z < 2.51 and z outside the range [1.15 ,1.24] and [1.75,1.98], suitable for Hα spectroscopy.
With this data we derived the star formation rate for this sources and also. Also we determined the spatial distribution and kinematics of star forming regions in these galaxies at the kilo-parsec scale. We found that the H alfa region it may not match with the continuum emission of the galaxies, besides we found evidence of galactic rotation.

6.82 Photometric properties of IR bright Dust Obscured Galaxies discovered by the Hyper Supreme-Cam on Subaru Telescope and WISE

Yoshiki Toba (Ehime University)

We present the photometric properties of infrared (IR) bright dust obscured galaxies (DOGs). DOGs are a subset of high-redshift (z ~ 2) optically-faint ultra-luminous infrared galaxies (ULIRGs), and are expected to be a crucial population to detect "growing black holes (BHs)".
Hyper Suprime-Cam (HSC) is a gigantic mosaic CCD camera with a 1.5 deg diameter FoV, which is attached at the prime focus of the Subaru Telescope. Combining the HSC and Wide-Field Infrared Survey Explorer (WISE), we discovered 26 D0Gs in the GAMA 14hr field. Among them, 21 (~ 81%) DOGs are power-law (AGN-dominated) DOGs and 5 (~ 19%) DOGs are bump (SF-dominated DOGs).
Assuming that their redshift distributions are 1.99 +/- 0.45 (Dey et al. 2008), we calculated their total IR luminosity that was estimated from an empirical relation between 22 micron luminosity and total IR luminosity. The average value of total IR luminosity is (2.05 +/- 0.15) times 10^13 solar luminosity which is recognized as hyper-luminous infrared galaxies (HyLIRGs).
In this presentation, we will also discuss their statistical properties such as luminosity function and luminosity density (Toba et al. 2015 in prep).

6.83 An AGN of a cluster early-type galaxy caught by MUSE

Yun-Kyeong Sheen (Universidad de Concepción)

6.84 Satellite Infall and Mass Deposition on the Galactic Center

Sofia Gallegos (PUC, Chile)

We modeled numerically the infall of a small satellite galaxy on to the inner 200 parsec of our Galaxy, to test whether such an event perturbs gas orbiting in the Central Molecular Zone (CMZ), as proposed by Lang et al (2013).
This process could have driven a large gas inflow around 10 Myr ago, explaining the past high accretion rate onto the super-massive black hole, and the presence of young stars in the inner parsecs of the Galaxy.
Our simulations show a very small inflow of gas, not sufficient to produce the aforementioned effects.

6.85 SINFONI observation of z~1.5 AGN

Isabelle Gavignaud (Universidad Andres Bello, Chile)

This poster presents the master tesis work of Astrid San Martin:
We present the observation of two AGN with SINFONI in the H-band. The original aim of this project was to observe if the host galaxies are kinematically disturbed and how this compare to the non-active galaxies. The brightest object QSO1, at z=1.31, has a Ha line luminosity of 8.26e45 erg/s whereas the second object QSO2 at z=1.55 has a luminosity of 4.38e44 erg/s. These QSO are at different phase of their accretion episode: QSO1 is at the peak of its quasar phase whereas QSO2's SMBH is starving. Our hypothesis is that the host galaxy contributes to the narrow-line component of the H_{α} line. In QSO1 we found a broad-component and a narrow-component, however it was not possible to spatially resolve the emission of the host galaxy. If we assume that the total flux of the narrow component is coming from the host galaxy we obtain an extremely large SFR and we conclude therefore that we are observing the AGN narrow line region. Whereas for QSO2 we only observe a broad component. With the Ha emission we estimate the black hole mass for both objects and compare it to the MgII based estimate.