WHAT DRIVES THE GROWTH OF BLACK HOLES?

An international workshop
26-29 July 2010
Durham, England

Programme and Abstracts

Durham University

Scientific organising committee
D Alexander, R Hickox, P Best,
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astro.dur.ac.uk/growthofblackholes/

Illustration courtesy NASA

Contents

What Drives the Growth of Black Holes?

An International Workshop, Durham, England 26–29 July 2010

http://astro.dur.ac.uk/growthofblackholes/

This workshop explores the processes that drive accretion onto supermassive black holes, from the most luminous distant quasars to more quiescent local systems. Currently there are conflicting discussions in the literature over which processes are most important, with different observations or theoretical studies often providing apparently contradictory results, as well as theorists often disagreeing with the observers.

One cause of these disagreements may be that we are exploring systems with a very wide range in black hole mass, Eddington ratio, redshift, and environment. This workshop aims to clarify the ranges of parameter space that are probed by different studies and help better understand how various key physical processes vary with these parameters.

The workshop has been organised into four main sessions that address the following questions:

1. How does gas accrete onto black holes, from kiloparsec to sub-parsec scales?
2. What are the links between black-hole growth and their host galaxies and large-scale environments?
3. What fuels the rapid growth of the most massive (and also the first) black holes?
4. What is the detailed nature of AGN feedback and its effects on black-hole fuelling and star formation?

Venue and Locations

Oral presentations	Kingsley Barrett Lecture Theatre, top floor of the Calman Learning Centre at Durham University
Posters, coffee & Sunday evening buffet reception	Derman Christopherson Room, adjacent to the Kingsley Barrett Lecture Theatre
Breakfast & lunches	Collingwood College
Workshop photograph & dinner	Durham Castle
Prince Bishop boat cruise	The Boathouse, Elvet Bridge

Presentation Information

Talks – All talks are 17 minutes with 3 minutes for questions. We are unfortunately not able to swap laptops for the presentations. We request that all speakers provide us with their talk on a thumb drive as far in advance as possible, in order to address any technical issues.

Posters – Posters are displayed for the duration of the workshop. The poster boards allow up to standard-sized posters (A0 or 36 x 48 inches); because of limited space, standard-size posters must be orientated vertically.

Invited Speakers

Richard Bower ● Niel Brandt ● Alison Coil ● Ric Davies ● Sarah Gallagher ● Stefan Gillessen
Martin Hardcastle ● Philip Hopkins ● Jarrett Johnson ● Andrew King ● Dieter Lutz ● Paul Martini
Brian McNamara ● Nicole Nesvadba ● Daniel Proga ● David Sanders ● Thaisa Storchi-Bergmann
Marianne Vestergaard ● Marta Volonteri ● Keiichi Wada

Scientific Organising Committee

David Alexander (Durham) ● Ryan Hickox (Durham) ● Philip Best (Edinburgh)
Ric Davies (MPE) ● Tiziana Di Matteo (Carnegie Mellon) ● Andy Fabian (Cambridge)
Jenny Greene (Princeton) ● Marta Volonteri (Michigan)

Local Organising Committee

Lindsay Borrero ● Kristen Coppin ● Alice Danielson ● James Geach ● Andy Goulding ● James Mullaney

Oral Programme

Sunday 25th July 2010

6.00–8.00 **Evening Buffet Reception at Calman Learning Centre**

Monday 26th July 2010

8.45 **Welcome and Introduction**

9.00 **Session 1, block 1** – *Chair: Alexander*

Storchi-Bergmann	Mapping gas inflows towards massive black holes in nearby active galaxies
Davies	The role of secular evolution in forming and fuelling AGN
Schartmann	Evolution from nuclear starbursts to discs and tori in AGN

10.30 **Coffee Break and Poster Session**

11.00 **Session 1, block 2** – *Chair: Davies*

Wada	Multi-phase ISM around an AGN: Effects of X-ray feedback on tens of parsecs
Ward	Constraints on black hole masses of narrow-line Seyfert 1s, from X-ray–optical SED fitting
Gillessen	Flaring in Sgr A*
Micic	Modeling the growth of the SMBH at the center of the Milky Way

12.30 **Lunch**

2.00 **Session 1, block 3** – *Chair: Bower*

Pedes	Time dependent models of star formation in AGN accretion discs
Power	Understanding black hole feeding and feedback from first principles
Dotti	Massive black hole binaries in circumnuclear discs
Gandhi	New insights on nuclei of nearby galaxies from high angular resolution mid-IR observations

3.30 **Coffee Break and Poster Session**

4.00 **Session 1, block 4** – *Chair: King*

Done	Black-hole accretion states and AGN activity
Roberts	ULXs: A local template for super-Eddington black hole growth
Mirabel	Cosmic evolution of stellar black holes and their role at the dawn of the Universe
Robinson	Probing gas flows around supermassive black holes with spectropolarimetry

5.30 **End**

Oral Programme

Tuesday 27th July 2010

9.00	**Session 2, block 1** – *Chair: Best*	
	Bower	Black holes, galaxy formation and the X-ray Universe
	Brandt	Black-hole ecology in the distant Universe: Results from cosmological X-ray surveys
	Schawinski	Black hole growth and its connection to host galaxy evolution
	Goulding	Towards a complete census of AGN activity in nearby galaxies: The incidence of growing black holes
10.30	**Coffee Break and Poster Session**	
11.00	**Session 2, block 2** – *Chair: Dunlop*	
	Best	The radio-AGN–host galaxy connection
	Merloni	A synthetic view of SMBH growth: Comparing and contrasting the radiative and mechanical sectors
	Fanidakis	Astrophysical aspects of SMBH evolution in the LCDM Universe
	Nardini	The relation between circumnuclear star formation and black hole growth in the mid-IR and hard X-rays
	Lutz	An infrared view on star formation in high-redshift AGN hosts
12.50	**Lunch**	
2.00	**Free afternoon**	
5:30	**Durham Castle tours begin**	
6.30	**Workshop photograph & drinks reception at Durham Castle**	
7.30	**Workshop dinner at Durham Castle**	
	After-dinner talk	What drives the growth of Icelandic volcanoes (and mass hysteria)? *Dr Colin Macpherson, Dept of Earth Sciences, Durham University*

Oral Programme

Wednesday 28th July 2010

9.00		**Session 2, block 3** – *Chair: Hickox*
	Silverman	Co-evolving AGN activity and star formation within the zCOSMOS density field
	Coil	The clustering of optical and X-ray AGN to $z = 1$
	Martini	The co-evolution of black holes and galaxies in clusters
	Alexander	The growth of black holes in distant overdense environments
10.30		**Coffee Break and Poster Session**
11.00		**Session 2, block 4** – *Chair: Frenk*
	Croton	Quasar vs. radio mode AGN heating and their environmental dependencies
	Shankar	Merger-induced quasars, their light curves, and their hosts
	Hopkins	Quasar fueling models, or, the missing link between galaxies and quasars
	Bellovary	How do black holes get their gas?
12.30		**Lunch**
2.00		**Session 3, block 1** – *Chair: Volonteri*
	Vestergaard	Black hole masses and Eddington ratios of quasars across cosmic history
	Peterson	Uncertainties in AGN black hole masses
	Sanders	The growth of massive black holes during gas-rich major mergers
	Coppin	Starburst or AGN dominance in submillimetre-luminous candidate AGN?
3.30		**Coffee Break and Poster Session**
4.00		**Session 3, block 2** – *Chair: Comastri*
	Page	Ionized winds in star-forming QSOs
	Hao	SEDs of AGNs from COSMOS: A single template with “torus-free” outliers
	Vignali	Obscured quasars at high redshifts
	Hickox	Clustering of obscured and unobscured quasars
5.30		**End**
7.00		**Prince Bishop Boat Cruise and Dinner**

Oral Programme

Thursday 29th July 2010

9.00		**Session 3, block 3** – *Chair: Siemiginowska*
	Volonteri	Growing the first black holes
	Fiore	Black hole growth at high redshift
	Johnson	Accretion onto the first black holes formed by direct collapse
	De Rosa	Probing the black hole growth and the chemical evolution of their hosts at $z \approx 6$
10.30		**Coffee Break and Poster Session**
11.00		**Session 4, block 1** – *Chair: Page*
	Decarli	The $M_{\rm bh}/M_{\rm host}$ relation in quasars from $z = 3$ to the Present Age
	Booth	The relations between black holes and their hosts: What determines the masses of supermassive black holes?
	Jahnke	Just good friends: The non-causal origin of black hole-galaxy scaling relations
	King	Black hole feedback in action
12.30		**Lunch**
2.00		**Session 4, block 2** – *Chair: Elvis*
	Gallagher	The role of the high energy continuum in quasar disk winds
	Proga	Detailed simulations of feedback
	Reeves	Ultra fast outflows from AGN and their role in feedback
	Evans	Do AGN outflows cease star formation? A new technique based on ultradeep *Chandra* HETG observations of NGC 1068
3.30		**Coffee Break and Poster Session**
4.00		**Session 4, block 3** – *Chair: La Franca*
	Nesvadba	Quantifying the impact of AGN feedback on the evolution of massive galaxies
	Mullaney	What is driving the feedback-inducing, extended outflows around AGNs?
	Hardcastle	Radio-loud AGN feedback: How and when does it work?
	McNamara	Are radio AGN powered by accretion or black hole spin?
5.30		**End**

Poster Programme

The posters have been divided into the four sessions that correspond to the main questions addressed at the workshop. Posters are displayed throughout the workshop in the Derman Christopherson Room. The numbers given below refer to the board on which each poster is displayed.

1. How does gas accrete onto black holes, from kiloparsec to sub-parsec scales?

Bartakova	1.1	PMAS-PPAK integral field spectroscopy of nearby Seyfert and normal spiral galaxies
Bregman	1.2	Resonant stars/disk interaction: implications for MBH evolution
Civano	1.3	A runaway BH in COSMOS: GW or slingshot recoil?
Floyd	1.4	Zooming in on quasar accretion
Ishibashi	1.5	Clumpy accretion flows in active galactic nuclei
Jungwiert	1.6	Growth of central supermassive blackholes and bulges due to bars and gas return from old stellar populations
Kuraszkiewicz	1.7	SED and emission line properties of the low redshift red 2MASS AGN
Lagos	1.8	Stellar and AGN accretion disc alignments from SDSS data *Presented by C Lacey*
Lawrence	1.9	Misaligned discs and black hole growth *Presented by M Elvis*
Westoby	1.10	A Magellan–IMACS-IFU Search for Dynamical Drivers of Nuclear Activity

Poster Programme

2. What are the links between black hole growth and their host galaxies and large-scale environments?

Aird	2.1	The evolution of the hard X-ray luminosity function of AGN
Akiyama	2.2	NIR spectroscopic survey of obscured AGNs at z∼2
Bradshaw	2.3	The Environments of AGN at High Redshift ($1.0 < z < 2.0$)
Cardamone	2.4	The disappearance of the Green Valley: AGN host galaxy populations at $z \sim 1$
Comastri	2.5	Heavily Obscured AGN in the deep XMM survey in the CDFS
Dunn	2.6	The prevalence and effects of AGN in clusters and ellipticals
Fan	2.7	Cosmic Evolution of Mass, Size, and Velocity Dispersion for ETGs
Feruglio	2.8	X-ray properties of power-law sources in COSMOS and CDFS
Geach	2.9	Lyα Blobs are powered by heating, not cooling
Herbert	2.10	A Sample of Radio Galaxies Spanning Three Decades in Radio Luminosity - The Fundamental Plane and Star Formation Histories
Kimm	2.11	Diffuse gas cooling onto satellite galaxies and its relevance on the black hole growth
Loiseau	2.12	X-ray selected AGNs in the North Ecliptic Pole field
Nugroho	2.13	Integral field spectroscopy of $z \sim 0.1$ QSO host galaxies
Raimundo	2.14	The effects of radiation pressure on the absorption in the *Chandra* Deep Field populations
Raychaudhury	2.15	The dependence of AGN activity on host and environment
Siemiginowska	2.16	Cluster–Quasar bound: 3C186, a quasar in a massive cluster at high redshift
Smolcic	2.17	Observational constraints on the importance of radio-mode feedback in massive galaxy formation
Symeonidis	2.18	The AGN content of infrared-selected luminous galaxies
Tugwell	2.19	X-ray properties of Infrared luminous galaxies *Presented by M Symeonidis*
Yan	2.20	Disentangle AGN and Star Formation at High Redshifts
Zuther	2.21	Borderline-type 1 QSOs: Probing AGN/host galaxy evolutionary aspects

Poster Programme

3. What fuels the rapid growth of the most massive (and also the first) black holes?

Allen	3.1	A dramatic increase in the fraction of broad absorption line quasars coincident with the epoch of rapid black hole growth
Bauer	3.2	Assessing obscured quasars at $z \sim 2$
Carrera	3.3	Exploring structure around submm-bright QSOs *Presented by M Page*
Cisternas	3.4	No merger-quasar connection since $z \sim 1$
Down	3.5	Modelling quasar accretion disks from Hα emission
Lietzen	3.6	Large scale environments of nearby quasars
Scharwaechter	3.7	Borderline type-1 QSOs: WiFeS integral field spectroscopy of early-stage QSO candidates
Trakhtenbrot	3.8	Measurements of $M_{\rm BH}$ and $L/L_{\rm Edd}$ in High-Redshift type-I AGN
Treister	3.9	Major Galaxy Mergers and the Growth of Supermassive Black Holes in Quasars

4. What is the detailed nature of AGN feedback and its effects on black hole fuelling and star formation?

Ammons	4.1	From WFC3/IR: The Quenching Effect of AGN Feedback on Host Galaxies
Barai	4.2	Implementation of AGN Feedback in Galaxy Formation: Spherical Tests of Bondi Accretion using SPH
Brusa	4.3	Feedback in action in a $z \sim 1.6$ XMM-COSMOS Obscured QSO
Gofford	4.4	High-resolution spectroscopy of AGN outflows in 3C445 and MR2251-178
Kim	4.5	BH mass and Bulge Luminosity Relation in Nearby Type I AGNs
La Franca	4.6	Tools for computing the AGN feedback: radio-loudness distribution and the kinetic luminosity function
Pope	4.7	Controlling cooling flows and optimal AGN feedback

Oral Programme Abstracts

Monday, 26th July 2010

Mapping gas inflows towards supermassive black holes in nearby active galaxies

Prof Thaisa Storchi-Bergmann | Instituto de Fisica - UFRGS, Brazil
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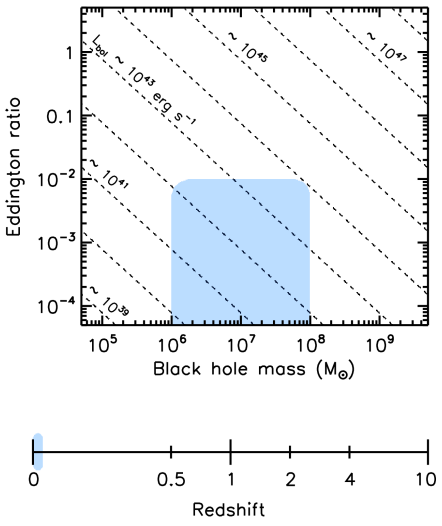
Abstract

The feeding of nuclear supermassive black holes in galaxies and the growth of their bulges require inflow of gas towards their nuclear regions. Nevertheless, most studies of the kinematics of the circumnuclear gas in active galaxies reveal outflows instead of inflows. In this talk I will report the results of a search for inflows around nearby Active Galactic Nuclei using Integral Field Spectrographs at the Gemini Telescopes. These observations reveal inflows in nuclear spirals and filaments, as well as compact rotating disks observed in ionized gas emission in the optical and in molecular gas emission in the near-infrared.



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The role of secular evolution in forming and fuelling AGN

Dr Ric Davies | Max-Planck-Institut fuer Extraterrestrische Physik
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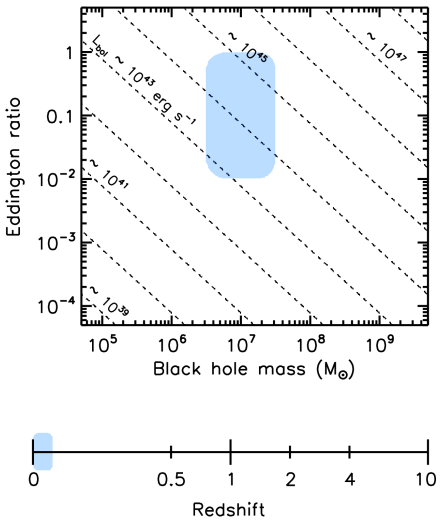
Abstract

Aiming to constrain the dynamical processes that dictate black hole accretion rates in Seyfert galaxies, we have begun a program in which we simultaneously probe the stellar and molecular gas properties from 1 kpc down to 10 pc in a matched sample of Seyfert and quiescent galaxies. I begin by presenting our preliminary results on the differences between the samples in terms of gas content, as well as kinematics and non-circular motions. I then turn to the special case of Narrow Line Seyfert 1s. In these galaxies, the black holes are thought to be accreting at close to their Eddington limit. In this contribution, we propose that NLS1s represent a class of AGN in which the black hole growth is, and always has been, dominated by secular processes. The work to address this fully is on-going, and here I outline the evidence for the key points in our argument. *30 min talk, some material on behalf of E Hicks*



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Evolution from nuclear starbursts to disks and tori in Active Galactic Nuclei

Dr Marc Schartmann | Max-Planck-Institut fuer Extraterrestrische Physik
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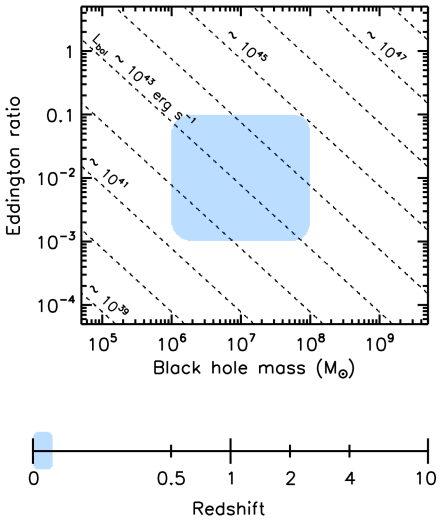
Abstract

Using high resolution hydrodynamical simulations, we model the stellar mass loss of massive, evolving nuclear star clusters, as found in a sample of nearby Seyfert galaxies. It drives turbulence in the surrounding interstellar medium and forms a vertically wide distributed clumpy or filamentary inflow of gas on large scales (tens of parsec) and a turbulent and very dense disc on the parsec scale. An effective disk model, pieced on to these simulations, enables us to account for star formation and to derive the long-term viscous evolution. Thereby, we can connect the tens of parsec scale region (observable with SINFONI) with the parsec scale environment (MIDI observations). Good agreement with observations is found.



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Multi-phase ISM around an AGN: Effects of X-ray feedback on tens of parsecs

Prof Keiichi Wada | Kagoshima University
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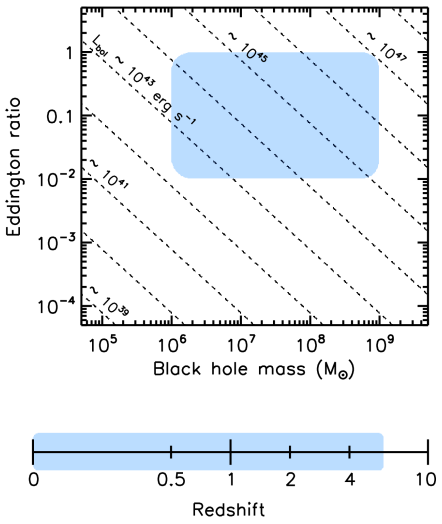
Abstract

Multi-phase gas around an AGN on several tens pc scale is discussed using full three-dimensional hydrodynamic simulations. I will especially focus on dynamical/chemical effects of the X-ray radiation on inhomogeneous molecular 'torus', whose turbulent motion is driven by star formation. Dynamics and structures of the ISM in this regions are important for fuelling toward the central engine.



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Constraints on Black Hole Masses of Narrow-Line Seyfert 1s, from X-ray–optical SED fitting

Prof Martin Ward | Durham University
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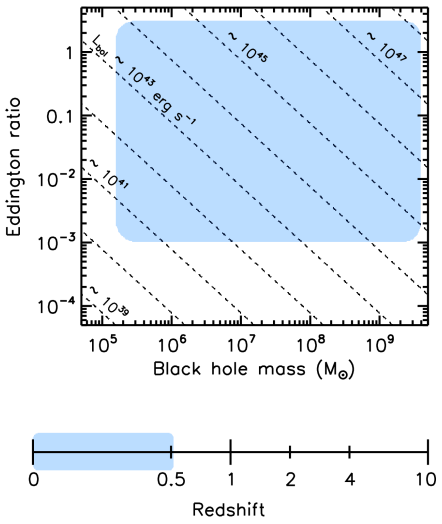
Abstract

We will present the latest results from our multiwavelength SED and X-ray variability studies of a sample of NLS1, selected from our data-base of 400 XMM-Newton serendipitious AGN which also have SDSS spectra and images. Although it is now recognised that broad line AGN (non-Seyfert 2s) display a continuous range of emission properties, nevertheless the so-called NLS1s do represent an important region of parameter space eg. their emission line gas velocities, often weak [OIII] and strong FeII lines, high amplitude X-ray variability and distinct soft X-ray properties. It is suggested that these properties map onto fundamental parameters such as the ratio of $M_{\rm BH}/\dot{M}$ and the Eddington ratio. Despite much effort over the past years, using absorption line dispersions, SED fitting, and host galaxy component deconvolution, the jury is still out over whether the NLS1s have distinctly lower black hole masses, and just how well they fit the $M_{\rm BH}$ vs. σ and stellar bulge correlations. We have undertaken detailed SED fitting of the continuum from 10 keV up to 1 micron, making corrections for stellar contamination in the optical and UV, subtracting FeII and other lines, and the Balmer continuum (small blue bump). In the X-ray region we fit a power-law, accretion disc and Compton components. The black mass is required as an input, but we are able to constrain the acceptable range of masses in a self consistent way, and hence show statistically whether it agrees with that predicted from the stellar estimates and the X-ray timing, when available. These results have broader implications for our understanding of the influence and evolution of the Eddington ratio and black hole growth across cosmic time.



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Flaring in Sgr A*

Dr Stefan Gillessen | Max-Planck-Institut fuer Extraterrestrische Physik
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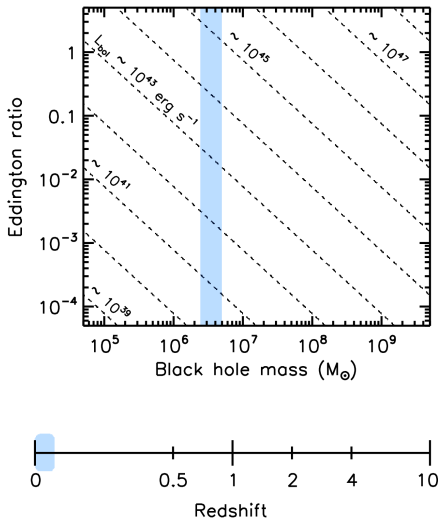
Abstract

The massive black hole in the centre of the Milky Way is a key laboratory to study interactions between stars, gas and the central object that are at play in galactic nuclei. Sgr A* is characterized by an overall extremely low accretion rate. Nevertheless, a few times per day the source brightens by up to two orders of magnitude in the infrared and even more in the X-ray domain. These flare events are extremely interesting since they happen in the innermost accretion zone, and hence they can act as unique probes for the accretion process and the strong gravitational field close to the event horizon. This talk focuses on the observational status of flares in Sgr A*, arguing that despite the great level of observational details available, many aspects of accretion onto Sgr A* are still open.



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Modeling the growth of SMBH at the center of Milky Way

Dr Miroslav Micic | SIfA, The University of Sydney
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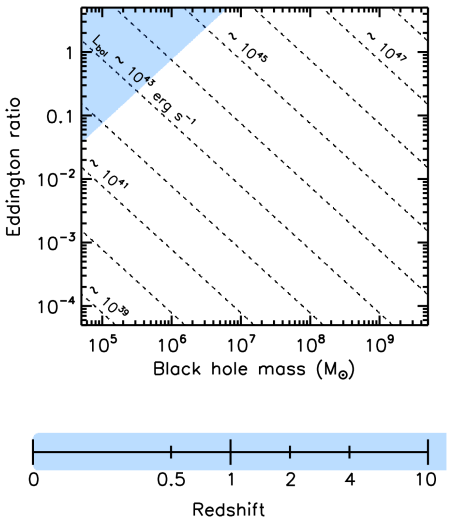
Abstract

I will present comparison of two classes of SMBH growth models. Models are build on Via Lactea II merger tree with 'painted on' semi-analytical mergers of galaxies and BHs; gas accretion; AGN feedback; and gravitational wave recoil. Model differences: 'black hole fundamental plane' limited BH growth (quasar mode) combined with Bondi-Hoyle accretion growth (radio mode) versus growth with merger driven BH gas accretion. We Monte-Carlo gravitational recoil, Bondi-Hoyle accretion rate, amount of gas converted into stars or available for accretion, and mass of black hole seeds in 20,000 merger tree realizations of BH mergers. We are looking for the model which reproduces Sgr A* in most realizations and provides observational predictions for population of massive BHs at the centers of 35 dwarf galaxies in the Local Group; population of rogue massive BHs in the Galactic Halo; and a population of ejected massive BHs.



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Time Dependent Models of Star Formation in AGN Accretion Discs

Mr Fabrizio Pedes | University of Leicester
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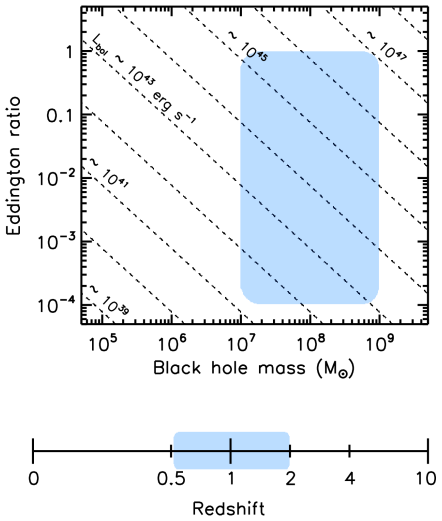
Abstract

Large and massive accretion discs are postulated to power AGN and quasars. However these discs are predicted to collapse against their self-gravity and form stars and planets. This sets a serious problem for SMBH feeding. In case of a rapid star formation, the gas content of accretion discs believed to feed these AGN may be completely depleted before accreting on the SMBH. Feedback of energy and momentum deposition into the disc by the forming stars may however slow down disc collapse, thus potentially solving this problem. Here we present a most detailed to date study of such models. Compared to previous steady-state work we implicitly include time-dependent evolution of such discs.



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Understanding Black Hole Feeding and Feedback from First Principles

Dr Chris Power | University of Leicester
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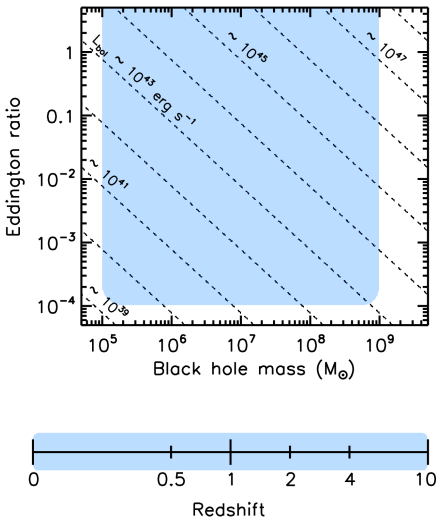
Abstract

Over the last decade it has become clear that feedback from supermassive black holes plays a crucial role in the formation and evolution of galaxies, but many details of this important process remain poorly understood. In this talk I will highlight some key results from my recent work on black hole feeding and feedback using analytical and numerical modelling. In particular I will discuss the importance of momentum-driven outflows in shaping the M-sigma relation. In addition, I will present a new physically motivated and self-consistent approach to estimating the black hole accretion rate in galaxy formation simulations whose predictions are quite different from the standard Bondi-Hoyle method.



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Massive black hole binaries in circumnuclear disks

Dr Massimo Dotti | Max Planck Institute for Astrophysics
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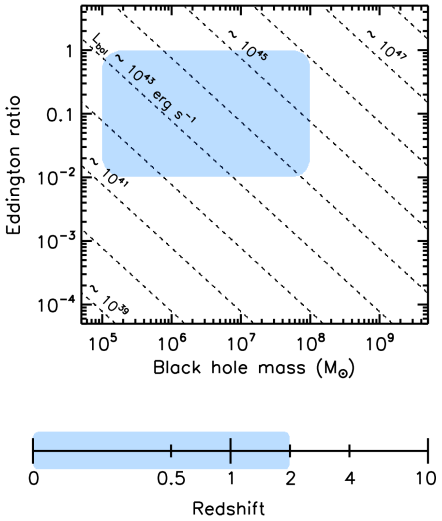
Abstract

The study of massive black hole dynamics is crucial for assessing the observational electromagnetic signatures of massive black hole binaries, the rate of massive black hole mergers detectable in the gravitational wave domain, and for determining the frequency of massive black holes in galaxies today. I will discuss the dynamical evolution, the accretion history, and the spin evolution of a massive black hole binary during the last stages of a gas rich galaxy merger.



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New insights on nuclei of nearby galaxies from high angular resolution mid-infrared observations

Dr Poshak Gandhi | JAXA, Japan
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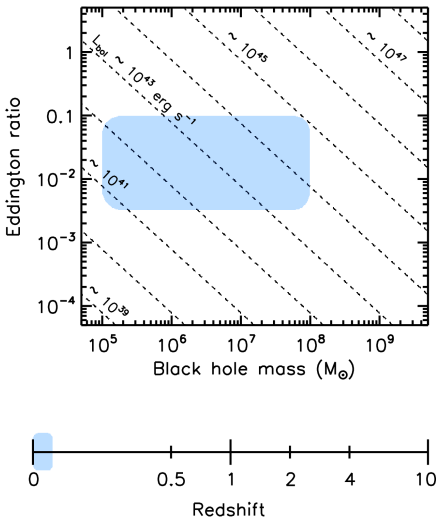
Abstract

I show how ground-based observations of active galaxies utilizing the exquisite diffraction-limited imaging capabilities of mid-infrared instruments on 10-m class telescopes are changing our understanding of these systems. For the first time, it has been possible to spatially resolve bright starburst emission from accretion activity in the cores of about 60 nearby Seyfert galaxies. Comparison with multi-wavelength data reveals a very strong correlation between the intrinsic X-ray and observed mid-IR luminosities, much stronger than expected from classic models of radiative transfer in tori with smoothly-distributed dust. All Seyfert types, including unobscured and heavily obscured ones, closely obey the X-ray:mid-IR correlation. It can also be used to accurately probe the intrinsic powers of the newly discovered population of 'buried' thick torus AGN. Hence, resolved mid-IR observations give a powerful new diagnostic on accretion activity. I will briefly review our observations with a variety of instruments at VLT and Subaru, including new data on sources at low luminosities, and will discuss implications for torus models.



Notes

Black-hole accretion states and AGN activity

Prof Chris Done | Durham University
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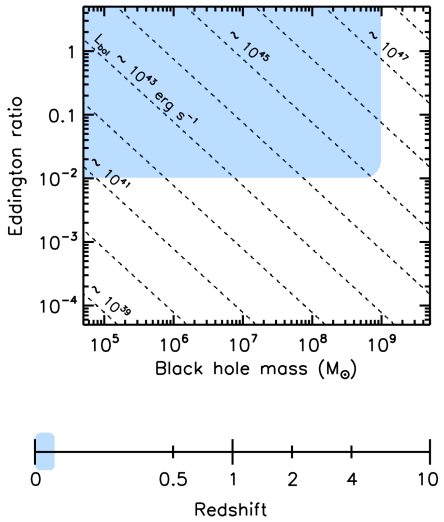
Abstract

I will review the X-ray emission and correlated jet seen from the accretion flow in black hole binary systems, and then scale these models up to supermassive black holes in AGN.



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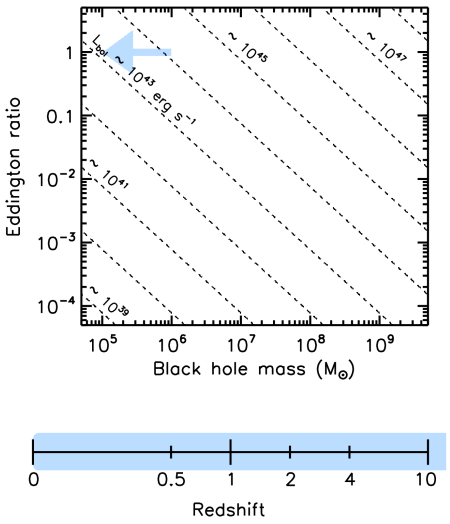
ULXs: a local template for super-Eddington black hole growth

Dr Tim Roberts | Durham University
t.p.roberts@durham.ac.uk

Abstract

Ultraluminous X-ray sources (ULXs) are the brightest extra-nuclear X-ray sources in nearby galaxies, thought to be fueled by accretion onto black holes (BHs). It is now thought that many of these ULXs may be accreting material at substantially super-Eddington rates; we will discuss the phenomenology associated with ULXs (including strong winds) and how this may provide a template for BH growth in QSOs at high redshift.



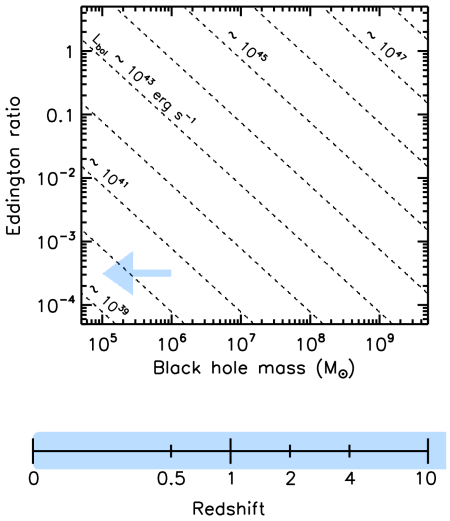
Notes

Cosmic evolution of stellar black holes and their role at the dawn of the Universe

Dr Félix Mirabel | CEA-Saclay-France & CONICET-Argentina
felix.mirabel@cea.fr

Abstract

Based on current theoretical models of the formation and collapse of primordial stars, and on the multiple observations of compact stellar remnants in the near and distant universe, I propose that a relatively large fraction of the first generations of massive stars may have imploded, ending as stellar black holes in high mass x-ray binaries. Monte Carlo simulations show that the x-ray radiation and energetic outflows from microquasars may have played a complementary role to the UV radiation from their massive stellar progenitors, heating and reionizing the intergalactic medium over large volumes of space, preventing the collapse of ordinary matter onto low mass dark matter haloes.



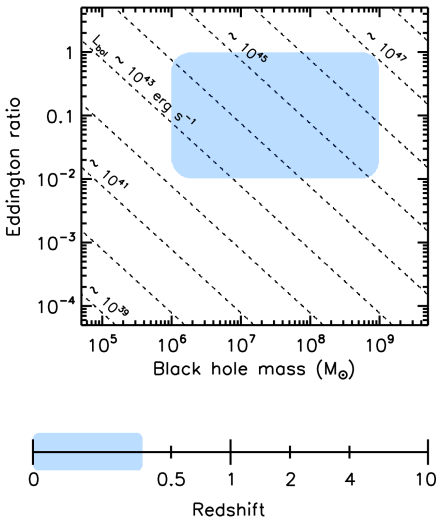
Notes

Probing gas flows around supermassive black holes with spectropolarimetry

Dr Andrew Robinson | Rochester Institute of Technology
axrsps@rit.edu

Abstract

The polarization state of the broad emission lines of Active Galactic Nuclei carries the imprint of the scattering geometry, which in turn provides information on the structure and kinematics of both the emitting gas and the scattering medium. In recent years we have reached a better understanding of the scattering geometry which, among other things, has made possible the determination of circum-nuclear mass flow rates from Doppler shifts in the scattered light spectrum. Here we report on some results from our study of a large sample of AGN spanning wide ranges in luminosity and broad-line width. These include the detection of clear observational signatures of an accretion disk wind in the low redshift quasar PG1700+518 and evidence for accretion flows on subparsec scales in several Seyfert 1 galaxies, including NGC4151. We also find that the polarization properties of narrow-line Seyfert 1 galaxies as a class are not consistent with a preferred (pole-on) viewing orientation and hence favour the idea that they are systems in which which a relatively low mass black hole is accreting at close to the Eddington rate.



Notes

Oral Programme Abstracts

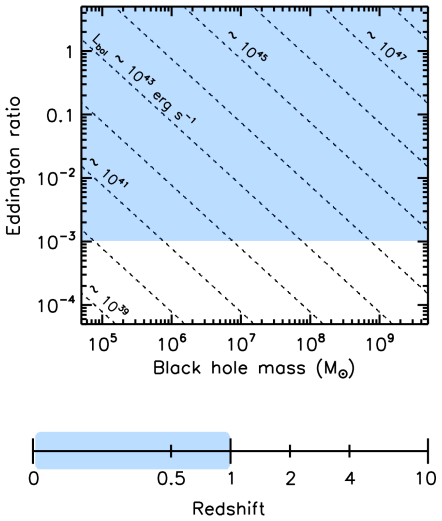
Tuesday, 27th July 2010

Black holes, galaxy formation and the X-ray Universe

Prof Richard Bower | Durham University
r.g.bower@durham.ac.uk

Abstract

I'll talk about the symbiotic relation between the growth of black holes and the formation of galaxies. I'll explore how ideas about black hole feedback can be tested using X-ray observations of the universe.



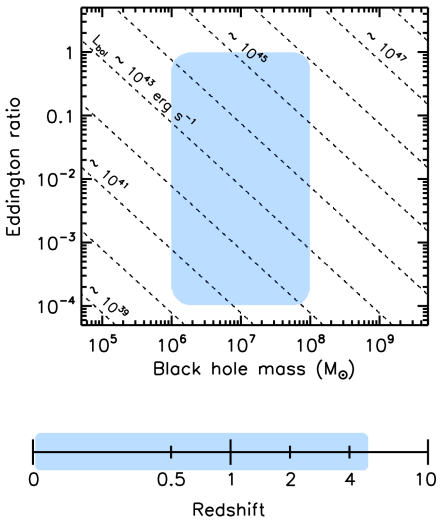
Notes

Black-Hole Ecology in the Distant Universe: Results from Cosmological X-ray Surveys

Prof Niel Brandt | Penn-State University
niel@astro.psu.edu

Abstract

Cosmological X-ray surveys over the past decade, mainly with Chandra and XMM-Newton, have dramatically improved understanding of the majority populations of active galactic nuclei (AGNs) over most of the history of the Universe. I will briefly review some of the exciting discoveries about AGNs from these surveys, focusing on 'ecological' results related to the interactions between black holes and their environments. Topics covered will include AGN host galaxies, connections between star formation and black-hole accretion, constraints upon AGN feedback modes, and effects of larger scale structures. I will also discuss some key unresolved questions and future prospects.



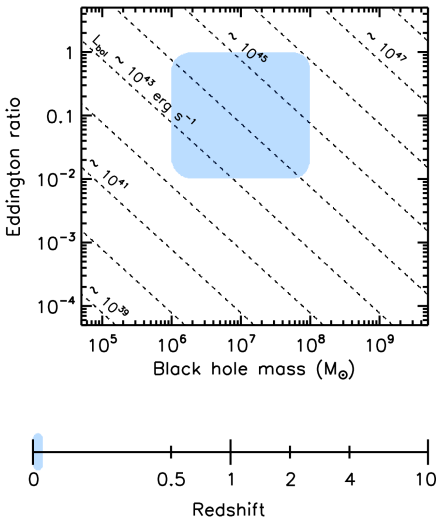
Notes

Black hole growth and its connection to host galaxy evolution

Dr Kevin Schawinski | Yale University
kevin.schawinski@yale.edu

Abstract

I will discuss new results from large surveys of the local Universe (SDSS & Galaxy Zoo) to show that the galaxy-black hole connection is fundamentally different in early- and late-type galaxies. Black hole accretion in early-type galaxies is proceeding at high Eddington ratios and occurs preferentially in the least massive part of the early-type galaxy populations. This black hole growth is associated with post-starburst host galaxies in the green valley whose progenitors experienced a merger ~ 0.5 Gyr in the past. The black hole growth in late-type galaxies occurs in hosts with similar bulge masses, and therefore black hole masses as that in early-type galaxies. However, the black holes in late-type galaxies that are actively accreting are the most massive of the late-type parent population. Their substantially larger host galaxy masses (factor $\sim$ 10) are due to the presence of massive, stable stellar disks. The Milky Way is in many ways the prototype for a late-type galaxy whose black hole is feeding in the local Universe, and we estimate there is a 10% probability that a galaxy like the Milky Way has active accretion onto its central black hole. While we see that black hole growth in early-types is a post-starburst phenomenon, we do not have a clear picture of the role of AGN in late-type galaxies.



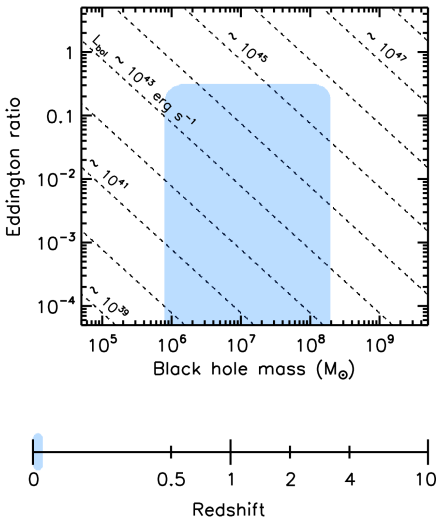
Notes

Towards a complete census of AGN activity in the most nearby galaxies: The incidence of growing black holes

Mr Andy Goulding | Durham University
andrew.goulding@dur.ac.uk

Abstract

Deep X-ray surveys have shown that the space density of high-luminosity AGNs peaked at higher redshifts than lower luminosity AGNs, suggesting that the most massive SMBHs ($M_{BH} > 10^8 M_{\odot}$) grew first. Hence, the most rapidly growing SMBHs in the local Universe should be of comparatively low mass ($M_{BH} < 10^7 M_{\odot}$). Using the most complete census of AGN activity to $D < 15$ Mpc (Goulding & Alexander 2009), we find that $\sim 50\%$ of the AGNs in the local Universe are missed in even the most sensitive optical surveys possibly due to extinction in the host galaxies, many of which contain relatively low-mass SMBHs ($M_{BH} \sim 10^6 M_{\odot}$). By combining X-ray data from *XMM-Newton*, *Suzaku*, *Swift* and *Beppo-SAX* with mid-IR spectroscopy from *Spitzer*-IRS we find that many of these AGNs appear to be intrinsically luminous objects which are heavily obscured at X-ray energies (< 10 keV). We constrain the relative mass accretion rates, and hence present-day growth rates of these AGNs and conclude that AGNs hosting SMBHs with $M_{BH} \sim 10^6 M_{\odot}$ are amongst the most rapidly growing in the local Universe.



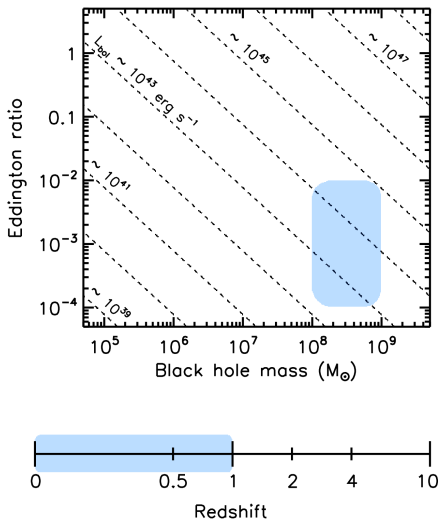
Notes

The radio AGN-host galaxy connection

Dr Philip Best | Royal Observatory, Edinburgh
pnb@roe.ac.uk

Abstract

I consider the energetic importance of low-luminosity radio-loud AGN in galaxy evolution in the nearby Universe, in particular distinguishing the roles of 'quasar-like' and 'low-excitation' radio sources. I further examine the evolution of the low luminosity radio-AGN population out to $z \sim 1$, and discuss the relevance of this for undersatanding the evolving importance of radio-AGN feedback.



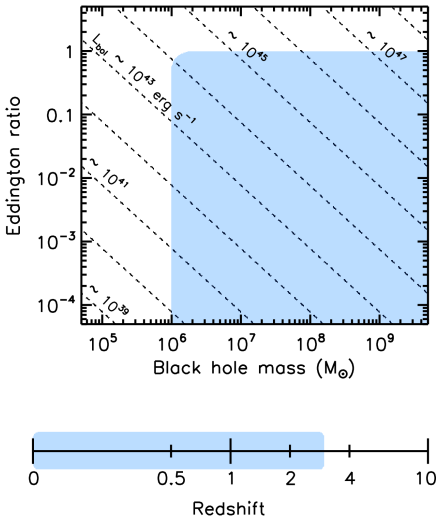
Notes

A Synthetic view of SMBH growth: comparing and contrasting the radiative and mechanical sectors

Dr Andrea Merloni | Excellence Cluster Universe and MPE, Garching, Germany
am@mpe.mpg.de

Abstract

I will describe the constraints available from a study of continuity equations for AGN evolution on the growth of the SMBH population in the two main 'modes' observed ('kinetic-' and 'radiatively-dominated', respectively). I'll show how SMBH mass function evolves anti-hierarchically, i.e. the most massive holes grew earlier and faster than less massive ones, and I will also derive tight constraints on observable AGN fractions, lifetimes and radiative efficiency. Finally, constraints on the redshift evolution of the AGN kinetic luminosity function will be discussed, thus providing a robust physical framework for phenomenological models of AGN feedback within structure formation.



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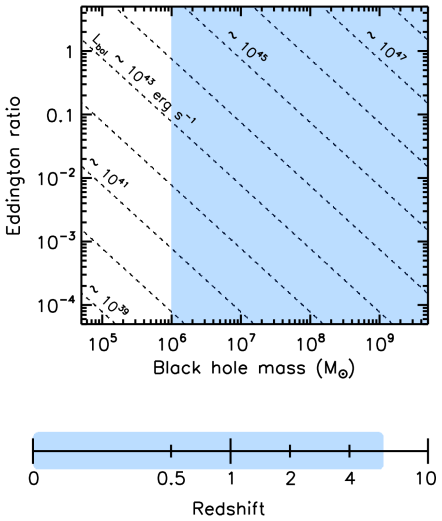
Astrophysical aspects of SMBH evolution in the LCDM universe

Mr Nikolaos Fanidakis | Durham University
nikolaos.fanidakis@dur.ac.uk

Abstract

I will focus on the Durham model for the growth of SMBHs. The model tracks the co-evolution of SMBHs and their host galaxies across cosmic time, a calculation embedded in the GALFORM semi-analytical model which simulates the formation and evolution of galaxies in a CDM universe. I will summarise our most important findings and explore the connection between SMBH spin and AGN radio loudness.



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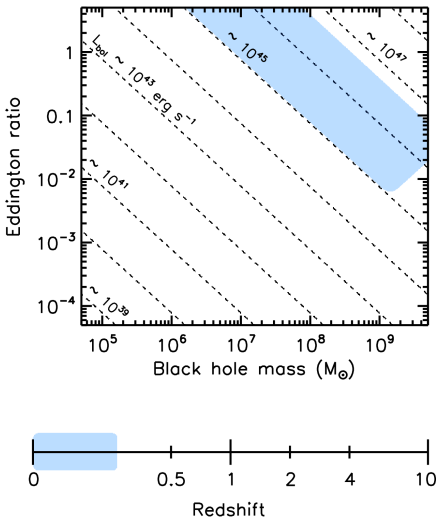
The relation between circumnuclear star formation and black hole growth in the mid-IR and hard X-rays

Mr Emanuele Nardini | INAF - Arcetri Observatory, Italy
nardini@arcetri.astro.it

Abstract

I present evidence for a strong link between circumnuclear star formation and black hole growth in local highly accreting AGNs, both unobscured (in narrow-line Seyfert 1s) and heavily obscured (inside ULIRGs). This work is based on new spectroscopic studies based on mid-IR (*Spitzer*) and hard X-ray (*XMM-Newton*, *Chandra*) data.



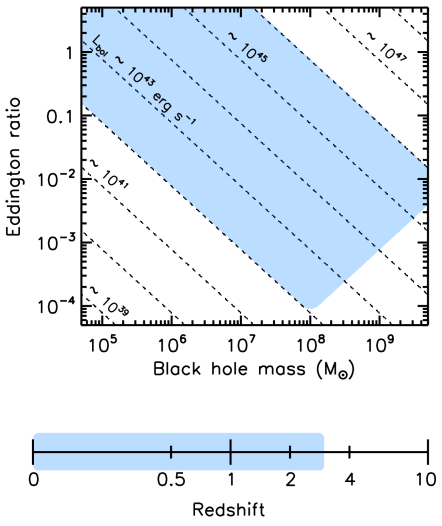
Notes

An infrared view on star formation in high-redshift AGN hosts

Dr Dieter Lutz | Max-Planck-Institut fuer Extraterrestrische Physik
lutz@mpe.mpg.de

Abstract

I will use mid-IR spectroscopic evidence to reconfirm the use of rest frame far-IR photometric measurements for quantifying star formation in high z AGN hosts. I will then use results from the first months of the Herschel mission as well as submm data from APEX to map the star formation in high z AGN, outlining a picture combining two paths of AGN/host coevolution. A correlation of AGN luminosity and host star formation is traced locally over a wide range of luminosities and also extends to luminous high z AGN. This correlation reflects an evolutionary connection, likely via merging. For lower AGN luminosities, star formation is similar to that in non-active massive galaxies and shows little dependence on AGN luminosity. The level of this secular, non-merger driven star formation increasingly dominates over the correlation at increasing redshift.



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Oral Programme Abstracts

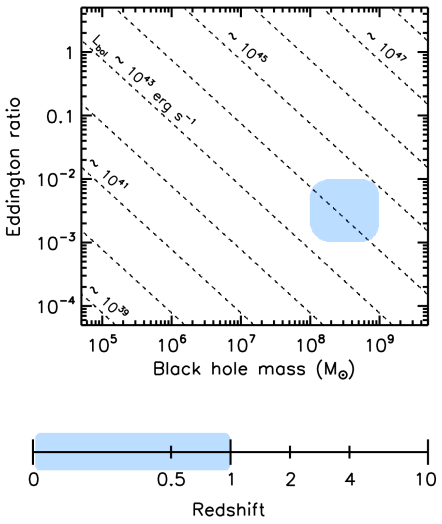
Wednesday, 28th July 2010

Co-evolving AGN activity and star formation within the zCOSMOS density field

Prof John Silverman | IPMU-The University of Tokyo
john.silverman@ipmu.jp

Abstract

An understanding of the influence of environment on both AGN activity and star formation is crucial to determine the physical mechanism(s) regulating the coeval growth of supermassive black holes (SMBHs) and the galaxies in which they reside. Deep multi-wavelength surveys (e.g., COSMOS) now offer the tools to explore in detail such studies up to $z \sim 1$ by providing least biased samples of AGN, a characterization of the underlying parent sample of galaxies, and an assessment of the local environment. I will present results based on 20k zCOSMOS galaxies with quality optical spectra and *XMM-Newton*/*Chandra* observations that identify those galaxies hosting X-ray selected AGNs including the obscured population. We specifically measure star formation rates of AGN host galaxies, growth rates of these SMBHs, and the influence of the environment on triggering AGN activity. Our findings (see Silverman et al. 2009a,b) shed light on the key ingredients for a galaxy to harbor an actively accreting SMBH and possible migration onto the local SMBH-bulge relations.



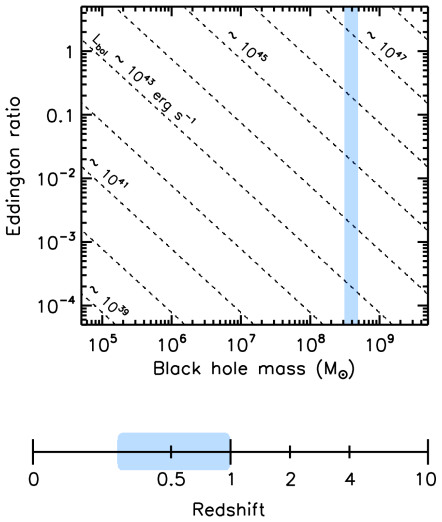
Notes

The Clustering of Optical and X-ray AGN to $z = 1$

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

Abstract

I will present an overview of the spatial clustering of both optical and X-ray selected AGN from $z = 0$ to $z = 1$, focusing in detail on studies that measure the cross-correlation of AGN with galaxies from both the DEEP2 and SDSS redshift surveys. I will compare the clustering strengths of various kinds of AGN with both star-forming and quiescent galaxies at the same redshift to constrain the AGN host galaxy type. I will include new results on the clustering of ROSAT AGN at $z = 0.25$ and show evidence for X-ray luminosity-dependent clustering.



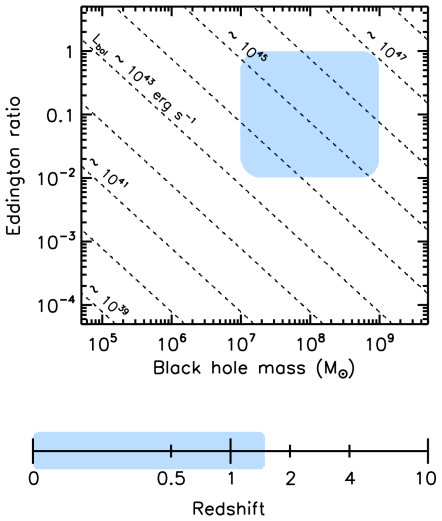
Notes

The Co-Evolution of Black Holes and Galaxies in Clusters

Prof Paul Martini | The Ohio State University
martini@astronomy.ohio-state.edu

Abstract

The evolution of AGN in clusters of galaxies traces the growth of some of the first and most massive black holes in the Universe. Observations have found that the fraction of AGN in clusters is consistently about an order of magnitude below the field fraction from $z = 1$ to the present. These results constrain the majority of cluster black hole growth to earlier times than field galaxies. We have now begun to measure star formation rates and stellar masses for galaxies in some of these same clusters. Intriguingly, the rate of galaxy growth, as traced by the fraction of galaxies with massive star formation, appears to have evolved in a similar manner to the AGN fraction. That is, the fraction of massively star forming galaxies in clusters is also suppressed by approximately an order of magnitude from $z = 1$ to the present. This suggests that there is also black hole and galaxy co-evolution in clusters, even though both star formation and black hole growth are approximately an order of magnitude less common.



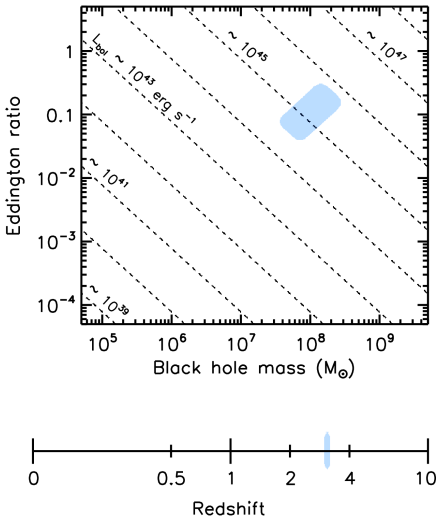
Notes

The growth of black holes in distant overdense environments

Dr David Alexander | Durham University
d.m.alexander@durham.ac.uk

Abstract

Deep blank-field X-ray surveys have revolutionized our understanding of the growth of black holes out to high redshifts. But, by design, these surveys trace typical regions in the Universe and provide limited constraints on the growth of black holes in overdense regions. I will present our current constraints on AGN activity and the growth of black holes in the $z = 3.09$ protocluster, a likely progenitor of a massive galaxy cluster such as Coma. I will compare these results with those found for lower-redshift galaxy clusters and typical field-galaxy regions to shed some light on the role of environment in the growth of black holes.



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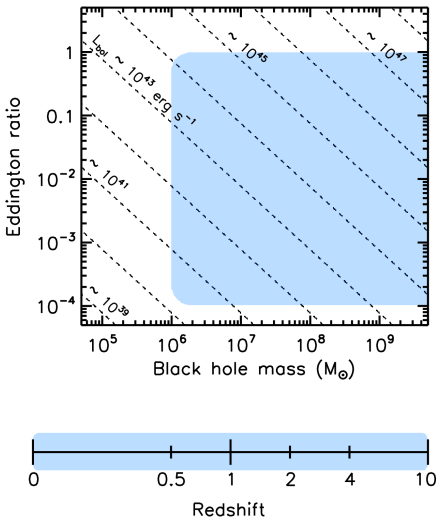
Quasar vs. radio mode AGN heating and their environmental dependencies

Dr Darren Croton | Swinburne University
dcroton@astro.swin.edu.au

Abstract

In this talk I will give an overview of the pros and cons of different AGN quenching mechanisms and their dependence on local galaxy and dark matter environment. This will be explored using galaxy and black hole formation models in an evolving cosmological context, from high redshift to the present day.



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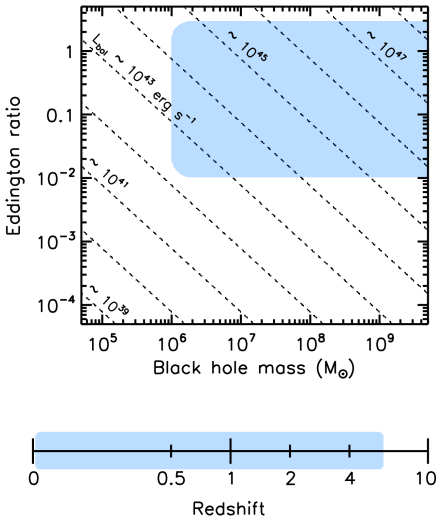
Merger-induced quasars, their light curves, and their hosts

Dr Francesco Shankar | Max Planck Institute for Astrophysics
shankar@mpa-garching.mpg.de

Abstract

We revisit a basic model of quasar activation by major mergers. The model consists of two main ingredients: the halo merger rate describing triggering; and a quasar light curve, which describes the evolution of individual quasars. We postulate a self-regulation condition between the peak luminosity and the mass of the host halo at triggering. This type of model is at the heart of the latest semi-analytic models (SAMs). We find: (1) that a mass and redshift-dependent quasar light curve is the most appropriate to match the statistics and clustering properties of quasars at all epochs; (2) the $z > 3$ SDSS clustering forces models to have a time delay between triggering and shining of the quasar $< 10^8$ yrs; (3) the $z < 0.3$ SDSS clustering forces faint sources to reside at the center of groups; (4) the data favour a redshift-dependent black hole mass-stellar mass ratio.



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Quasar Fueling Models, or, The Missing Link Between Galaxies and Quasars

Dr Philip Hopkins | University of California, Berkeley
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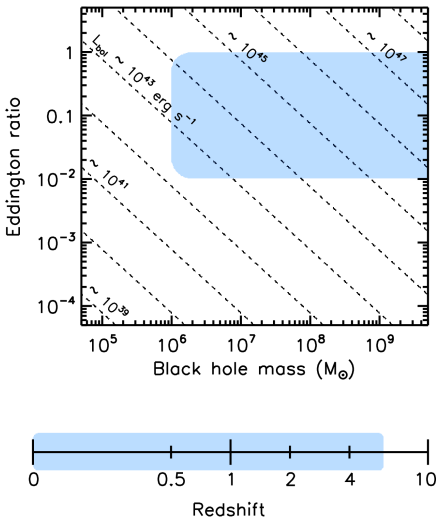
Abstract

Super-massive black holes (SMBHs) and AGN are of fundamental interest both in their own right and to cosmology and galaxy formation. However, the physics of angular momentum transport from galactic scales to an accretion disk is one of the outstanding problems in our understanding of the formation and evolution of SMBHs. New, multi-scale hydrodynamic simulations can probe these scales and show for the first time that, when the proper physics is included, gravitational instabilities can drive inflow rates down to a viscous accretion disk sufficient to power the most luminous quasars. The last stage of this instability takes the form of a lopsided eccentric nuclear disk. Seemingly unrelated observations have discovered that there is a lopsided stellar disk of unknown origin orbiting the BH in M31, and possibly many other systems. I'll discuss how these nominally independent puzzles are in fact closely related – the disk in M31 and other nearby galaxies may in fact be the 'smoking gun' for these instabilities and tell us how and when SMBHs were grown. The same disk dominates the AGN obscuration, and may be the putative "torus" invoked to explain obscured active galactic nuclei and the cosmic X-ray background. I'll discuss the implications of these simulations for BH fueling, quasar activity and obscuration, and the evolution of BH spin. Finally, I'll discuss what this means for models of AGN feedback and its effects on galaxy formation.



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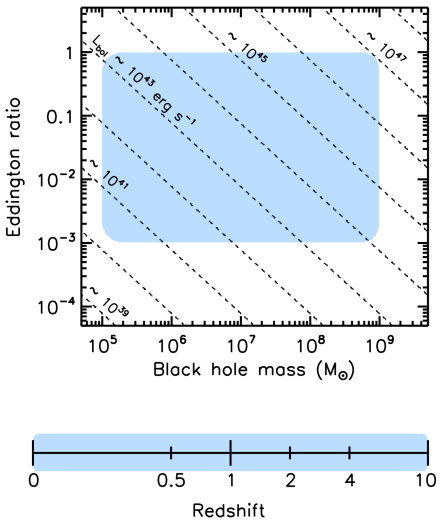
How Do Black Holes Get Their Gas?

Ms Jillian Bellovary | University of Washington
jillian@astro.washington.edu

Abstract

We test the common assumption that the majority of black hole growth occurs during major mergers by running a suite of cosmological simulations of galaxies with a variety of masses and merger histories. We isolate and trace the history of gas accreted by black holes, determining whether the majority of accretion events originate from major mergers, cold flows, or from other processes. In addition, we examine how these effects vary with halo mass, black hole mass, and merger history.



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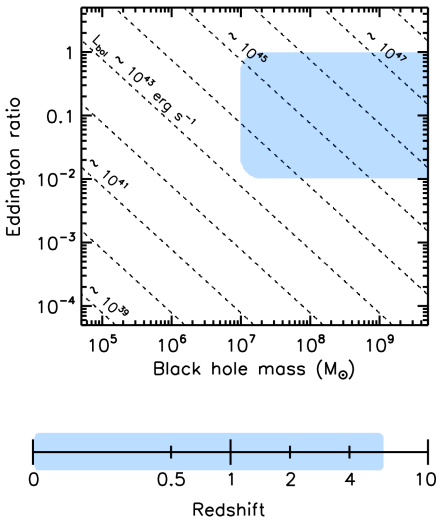
Black Hole Masses and Eddington Ratios of Quasars across Cosmic History

Dr Marianne Vestergaard | Dark Cosmology Centre
vester@dark-cosmology.dk

Abstract

To fully understand the detailed cosmological role of supermassive black holes in galaxies at various evolutionary stages we need to also understand the demographics and accretion history of black holes and how they form and grow across cosmic time. After a brief overview of mass determinations of actively accreting black holes in this talk I will outline the inferred black hole mass and Eddington luminosity ratios obtained when we examine various large surveys of quasars that cover a broad range of cosmic history. If time permits, I will summarize our recent results on the quasar black hole mass functions.



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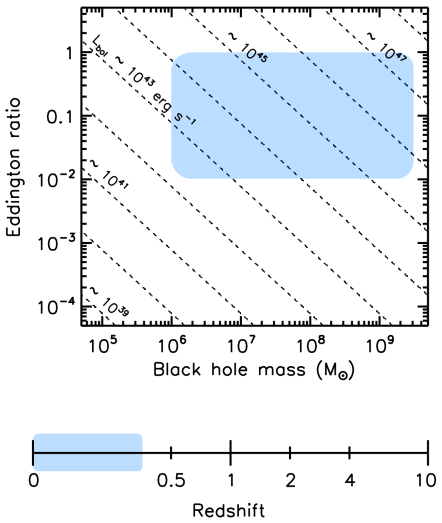
Uncertainties in AGN Black Hole Masses

Prof Bradley Peterson | Ohio State University
peterson@astronomy.ohio-state.edu

Abstract

Beyond the local universe, the masses of supermassive black holes are easier to measure in AGNs than in quiescent galaxies, either by using the direct method of reverberation mapping or by using various indirect scaling methods that are anchored by reverberation mapping. We are investigating the uncertainties in reverberation mapping measurements, with particular attention to systematic effects that could bias measurements in one direction or another and the intrinsic scatter in relationships that can be used to indirectly infer black hole masses. We are also attempting to determine the intrinsic scatter in the relationship between the broad-line region size and AGN luminosity (R–L) and between the black hole mass and host-galaxy bulge luminosity (M–L) since this will determine future observational strategies: if the intrinsic scatter is large, many reverberation measurements are needed to simply decrease statistical uncertainties. On the other hand, if the intrinsic scatter is small, it is better to concentrate on obtaining higher-quality reverberation measurements. Our preliminary analysis shows that both the R-L and M–L relationships have surprisingly little intrinsic scatter.



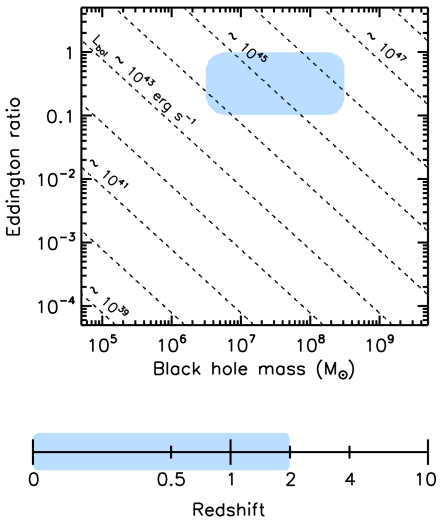
Notes

The Growth of Massive Black Holes during Gas-Rich Major Mergers

Prof David Sanders | IfA, University of Hawaii
sanders@ifa.hawaii.edu

Abstract

Massive Black Holes ($> 10^8 M_\odot$) are most likely to have been produced during major mergers ($\sim L^\star - L^\star$) of gas-rich spirals. I will review current evidence which suggests that the major growth period of these MBH ($\times 100$) occurs during a time interval of a few $\times 10^8$yrs, coinciding with an ultra-luminous infrared phase when the merger nuclei are still heavily enshrouded in dust.



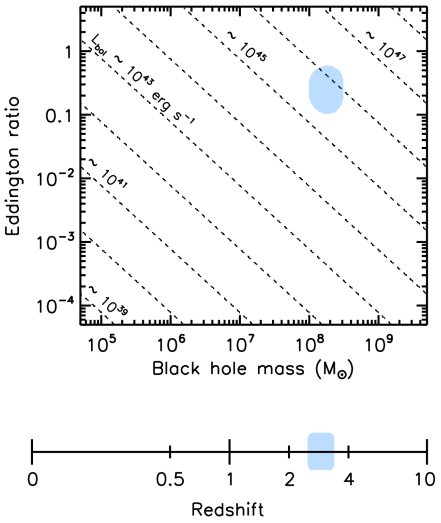
Notes

Starburst or AGN dominance in submillimetre-luminous candidate AGN?

Dr Kristen Coppin | Durham University
kristen.coppin@durham.ac.uk

Abstract

It is widely believed that starbursts/ULIRGs and AGN activity are triggered by galaxy interactions and merging; and SMGs seem to be simply high redshift ULIRGs, observed near the peak of activity. In this evolutionary picture every SMG would host an AGN, which would eventually grow a black hole strong enough to blow off all of the gas and dust leaving an optically luminous QSO. In order to probe this evolutionary sequence we have focussed on the 'missing link' sources, which demonstrate both strong starburst and AGN signatures, in order to determine if the starburst is the main power source even in SMGs when we have evidence that an AGN is present. The best way to determine if a dominant AGN is present is to look in the mid-infrared for their signatures, since often even deep X-ray observations miss identifying the presence of AGN in heavily dust-obscured SMGs. We have obtained deep Spitzer-IRS coverage of a sample of SMGs that are good candidates for harboring powerful AGN based on their IRAC colours. I will present the results of our audit of the energy balance between star-formation and AGN within this special sub-population of SMGs – where the BH has grown appreciably to begin heating the dust emission.



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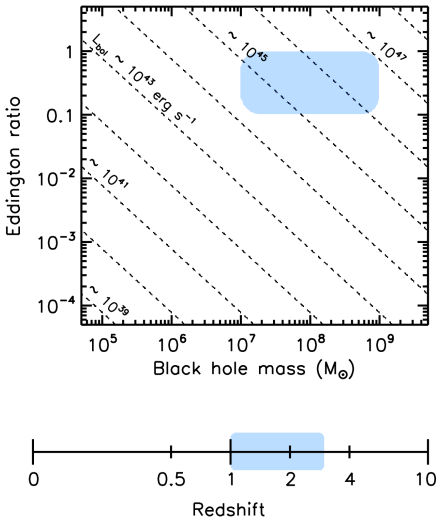
Ionized winds in star-forming QSOs

Dr Mat Page | MSSL, University College London
mjp@mssl.ucl.ac.uk

Abstract

A significant population of broad-line $z = 2$ QSOs have heavily absorbed X-ray spectra. Submm observations show that these QSOs are embedded in ultraluminous starburst galaxies, unlike most unabsorbed QSOs at the same redshifts and luminosities. The radically different star formation properties between the absorbed and unabsorbed QSOs implies that the X-ray absorption is unrelated to the torus invoked in AGN unification schemes. Instead, these objects represent a transitional phase in an evolutionary sequence relating massive black holes and the formation of galaxies. Prior to this phase, the galaxy is rapidly forming its stars, and the growth of the black hole is obscured. After the X-ray absorbed phase, the naked QSO shines brightly, and its host elliptical galaxy is essentially fully formed. The most puzzling question about these objects has always been the nature of the X-ray absorber. I will present a study of the X-ray absorbers based on deep (50–100ks) *XMM-Newton* spectroscopy, and show that the absorption is due to a dense, ionised wind driven by the QSO, with a kinetic luminosity compatible with the theoretical requirements for producing the M–σ relation.



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SEDs of AGNs from the COSMOS Survey: A Single Template with "Torus-free" Outliers

Ms Heng Hao | Harvard-Smithsonian CfA
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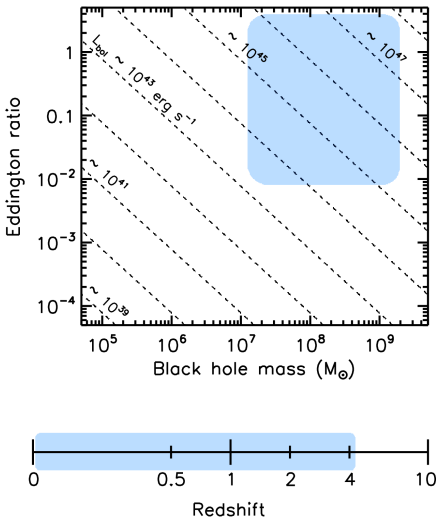
Abstract

The spectral energy distributions (SEDs) of active galactic nuclei (AGNs) are essential to understand the physics of the super massive black holes (SMBHs). We present a detailed study of the evolution of AGN SED shapes in the optical-near-IR for 406 XMM selected Type 1 AGNs from the COSMOS Survey as a function of luminosity, redshift and Eddington ratio. We define an index-index ('colour-colour') diagram to investigate the mixture of AGN continuum, reddening and host galaxy contribution. We found that most of the sample lie on the mixing curves between the Elvis et al. (1994) mean AGN SED (E94), E94, and a host galaxy, with only the modest reddening expected in type 1 AGNs. Lower luminosity and Eddington ratio objects have more host galaxy. The E94 template is remarkably good in describing the SED shape in the 0.3–3 micron decade. There is however a group of AGNs, which seem more prominent at high redshift/luminosity which have weak or non-existent near-IR bumps, suggesting a lack of hot dust. We investigate the other properties of this sample compared with more typical AGNs. These 'torus-free' objects might be AGNs in a different evolutionary stage compared to normal AGNs.



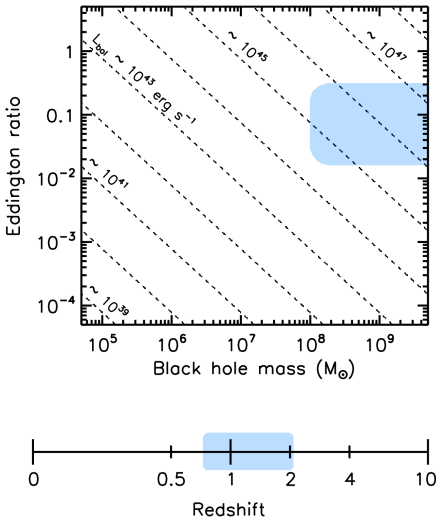
Notes

Obscured quasars at high redshifts

Dr Cristian Vignali | Dipartimento di Astronomia, Universita' di Bologna
cristian.vignali@unibo.it

Abstract

Over the last decade, X-ray and infrared surveys have offered powerful selection criteria towards a more complete census of the population of luminous, obscured (Type 2) quasars. The obscured growth phase of AGN at high redshifts is likely related to feedback processes involving the host galaxy; an attractive link has been proposed between the end of such phase and the quenching of the star-formation activity. We present the multi-wavelength properties for a sample of hard X-ray selected Type 2 quasars over the $z = 0.9$–2.1 redshift range using Spitzer observations. For these AGN, estimates on the bolometric luminosities and Eddington ratios are presented and compared to other AGN samples. Few examples of the coupled AGN/star-forming activity at high redshift will be presented, and particular emphasis will be given to the intriguing case of an X-ray luminous, obscured quasar at $z = 2$ experiencing a phase of coeval nuclear activity and considerable star formation.



Notes

Clustering of obscured and unobscured quasars

Dr Ryan Hickox | Durham University
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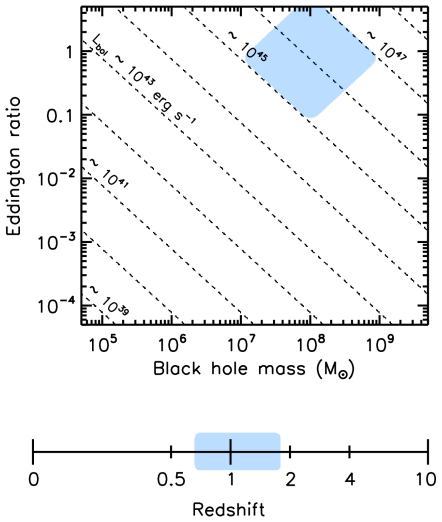
Abstract

The spatial correlations of quasars provide valuable clues into their fueling mechanisms and links to galaxy evolution, but have largely been limited to unobscured, optically selected samples. Using *Spitzer*, moderately obscured quasars can now be identified based on mid-infrared SEDs. I will present the cross-correlation of IR-selected quasars with photometric galaxies in the redshift range $0.7 < z < 1.8$, using data from the wide-field Bootes survey and employing a new technique developed by Myers et al. which uses the full probability function of photometric redshifts. This analysis allows us to compare the typical dark matter halo masses of equivalent samples of obscured and unobscured quasars, as well as studying their local environments on small ($<$ few hundred kpc) scales, which may provide useful constraints on models in which quasars are fueled by mergers or interactions.



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Oral Programme Abstracts

Thursday, 29th July 2010

Growing the first black holes

Dr Marta Volonteri | University of Michigan
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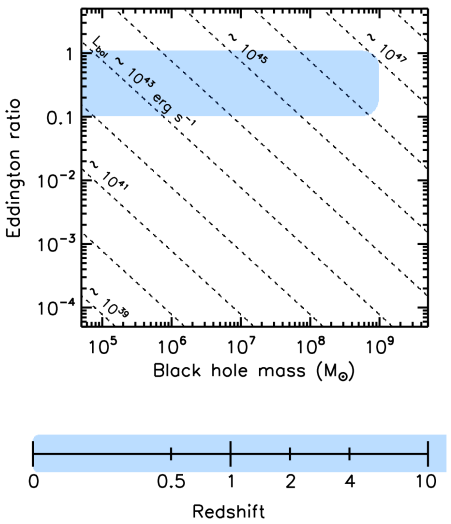
Abstract

The advances in observational cosmology and extragalactic astronomy have shed light on the evolution of the massive black hole population, as traced by quasar activity, up to $z \sim 4$–6. We do know that massive black holes are there, but we do not know how they got there. The early evolution of massive black holes, and most notably, what physical mechanism is responsible for their formation are still unknown. In this talk I will address basic, but critical, questions on the cosmological significance of massive black holes. What physical mechanisms lead to the formation of the first massive black holes? How massive were the initial massive black hole seeds? When and where did they form? How fast did they grow?



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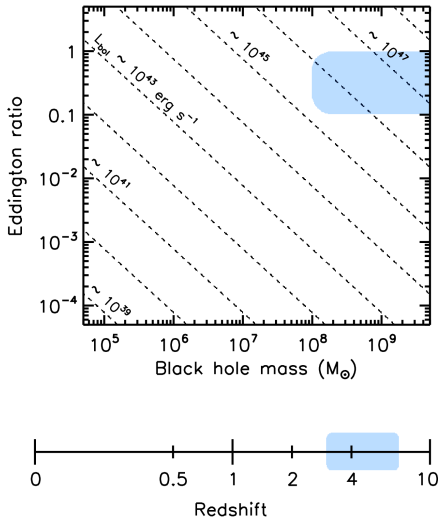
Black hole growth at high redshift

Prof Fabrizio Fiore | INAF-OAR
fiore@oa-roma.inaf.it

Abstract

I will present a seach for high-z AGN in the CDFS and COSMOS fields, and compare the $z > 4.5$ AGN luminosity function with analytic and semi-analytic predictions of BH growth at high redshift.



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Accretion onto the first black holes formed by direct collapse

Dr Jarrett Johnson | Max-Planck-Institut fuer Extraterrestrische Physik
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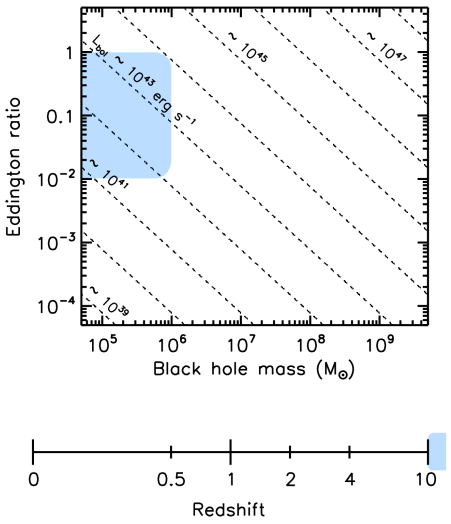
Abstract

One possible scenario for the formation of massive black holes (BHs) in the early Universe is from the direct collapse of primordial gas in atomic-cooling dark matter haloes in which the gas is unable to cool via molecular transitions. We study the formation of such BHs, as well as the accretion of gas onto these objects and the high energy radiation emitted in the accretion process, by carrying out a cosmological radiation hydrodynamics simulation. We find that accretion rates onto the central object which forms from the initial collapse of the hot ($\sim 5 \times 10^3$ K) gas are of the order of 10^{-1} $M_\odot$ yr^{-1}, high enough for the formation of a central object with a maximum mass of the order of 10^5 $M_\odot$. Assuming that this central object collapses to form a BH with a mass of the same order, we track the subsequent accretion of gas onto the BH self-consistently with the ionizing radiation emitted from the accretion disk. Using a ray-tracing algorithm to follow the propagation of ionizing radiation, we are able to model in detail the growth and evolution of the H ii and He iii regions which form around the accreting BH, and so to compute the expected spectral signatures of these objects. Future missions, such as the *James Webb Space Telescope*, may be able to detect the nebular emission from the photoionized primordial gas surrounding such BHs.



Notes

Probing the black hole growth and the chemical evolution of their hosts at $z \sim 6$

Miss Gisella De Rosa | Max Planck Institute for Astronomy, Heidelberg
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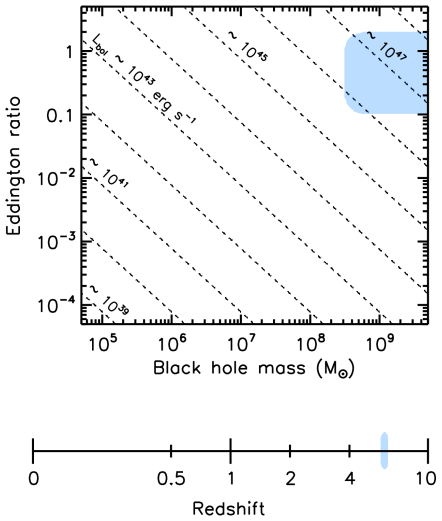
Abstract

High redshift quasars are the best probes of the early growth of supermassive black holes (BHs) and allow to study the relation between early galaxies and BH formation. Among the most surprising discoveries in this field are the detection of BH masses $> 10^9 M_\odot$ and the apparent lack of evolution of the broad line region (BLR) metal enrichment. However until now only extremely luminous objects at high redshift have been studied. We present the first results of our ongoing program for the observations of faint $z \sim 6$ quasars. The new VLT/ISAAC observations of three SDSS QSOs ($19.6 < z_{AB} < 20.7$) expand the existing sample towards the faint end of the quasar luminosity function, allowing an unprecedented homogeneous statistical study of the properties of these objects. Preliminary results of a $z_{AB} = 20.9$ quasar reveal the lowest BH mass and one of the highest Eddington ratios ever detected at this redshift.



Notes

The M_{BH}–$M_{\rm Host}$ relation in quasars from $z = 3$ to the Present Age

Dr Roberto Decarli | Max Planck Institute for Astronomy, Heidelberg
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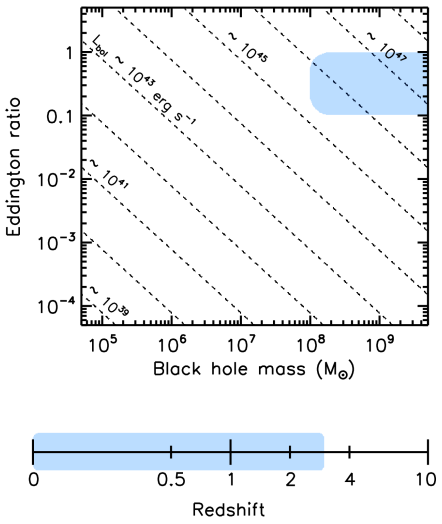
Abstract

We study the dependence of the M_{BH}–$M_{\rm Host}$ relation on the redshift up to $z = 3$ for a sample of 96 quasars the host galaxy luminosities of which are known. Black hole masses were estimated assuming virial equilibrium in the broad line regions, while the host galaxy masses were inferred from their luminosities. We show that, in the sampled redshift range, the M_{BH}–L_{Host} relation remains nearly unchanged. Once we take into account the aging of the stellar population, we find that the $M_{BH}/M_{\rm Host}$ ratio (Γ) increases by a factor ~ 7 from $z = 0$ to $z = 3$. We show that Γ evolves with z regardless of the radio loudness and of the quasar luminosity. We propose that most massive black holes, living their quasar phase at high-redshift, become extremely rare objects in host galaxies of similar mass in the local Universe.



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The relations between black holes and their hosts: What determines the masses of supermassive black holes?

Dr Craig Booth | Leiden University
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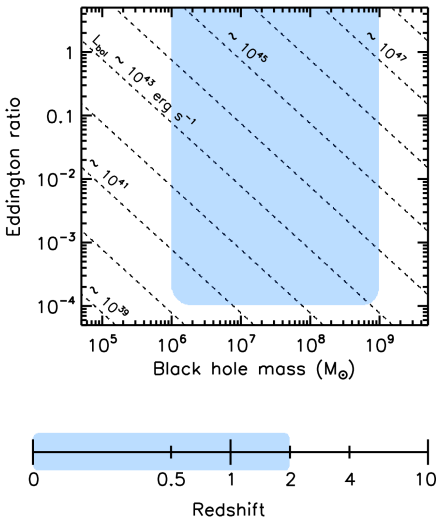
Abstract

Almost all massive galaxies are thought to contain a central supermassive black hole (BH) and the properties of these BHs are tightly correlated with those of the galaxies in which they live. It is known that most of the mass of the BHs is assembled via luminous accretion of matter. The energy and momentum deposited by the radiation from the accretion flow can halt or even reverse the inflow, providing a natural mechanism for BHs to regulate their growth and to couple their properties to those of their host galaxies. We employ state-of-the-art cosmological, hydrodynamical simulations to probe the relations between BHs and their hosts, ask how these relations evolve through cosmic time and investigate what physical processes determine the masses of supermassive BHs.



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Just good friends: The non-causal origin of the black hole–galaxy scaling relations

Dr Knud Jahnke | Max Planck Institute for Astronomy
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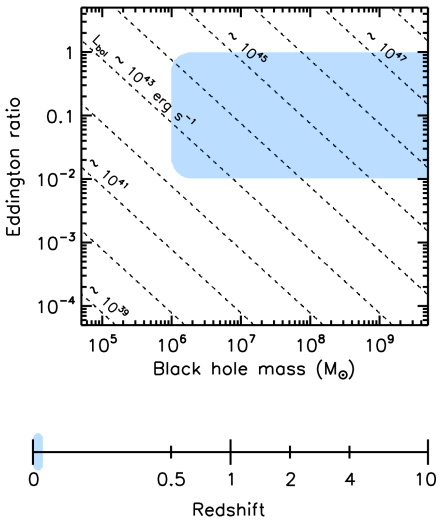
Abstract

A decade ago, one of the primary and most intuitive interpretations of the newly discovered black hole–galaxy scaling relations was that the formation histories of BHs and galactic bulges must be coupled. Scenarios invoked on this basis included AGN feedback mechanisms that provided self-regulation cycles of BH growth and potentially also star formation. Very successful simulations visualized this effect.

As we recently showed, the real "coupling" of BH and stellar growth in galaxies is in fact different from this picture: By simply tracing the assembly process of galaxies and black holes in realistic LCDM merger trees, we were able to show that the formation of scaling relations between BH and bulge mass does not require any physical driver. It is the natural outcome of the assembly process, and generally invariant with respect to a wide range of (initially uncorrelated) initial conditions.

The specific details of BH fuelling and SF mechanisms will determine scatter and exact slope of the BH–bulge mass relation, but there is no per-galaxy coupling necessary to even reproduce the correct slope of the relation or even the correct deviation from a simple linear law.

The observed scaling relations are simple correlations - which remains true - and both their scatter and evolution with cosmic time can be used as constraints on BH accretion mechanisms. Finally, since we prove that AGN feedback is not a required ingredient in creating the BH–galaxy scaling relations - though it is still a possible mechanism in galaxy formation - models of AGN feedback are liberated from having to reproduce this additional constraint. Any large scale galaxy formation model will basically get the scaling relations for free.



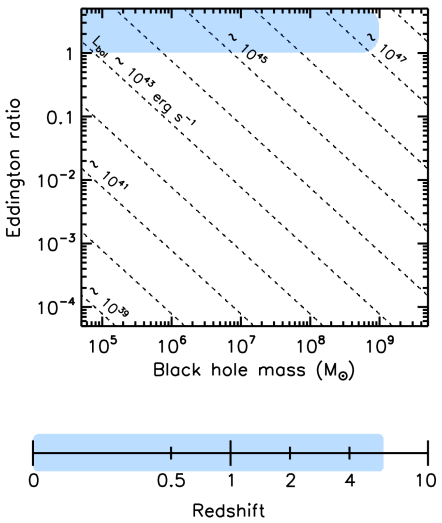
Notes

Black Hole Feedback in Action

Prof Andrew King | University of Leicester
ark@astro.le.ac.uk

Abstract

Eddington accretion episodes in AGN are likely to produce winds with velocities $v \sim 0.1c$ and ionization parameters implying the presence of resonance lines of helium– and hydrogenlike iron. These properties are direct consequences of momentum and mass conservation. I consider the impact of these winds on the interstellar medium of the host galaxy. This produces a number of outflow effects, and ultimately the M - sigma and black-hole - bulge mass relations.



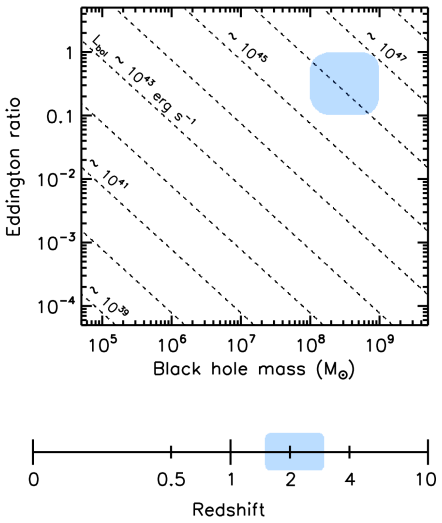
Notes

The Role of the High Energy Continuum in Quasar Disk Winds

Dr Sarah Gallagher | University of Western Ontario
sgalla4@uwo.ca

Abstract

In addition to being interesting in its own right, quasar feedback in the form of radiatively launched, accretion-disk winds holds promise as a means of affecting star formation in gas-rich galaxies at high redshift. Significant progress is being made in fleshing out the details of this mechanism by incorporating observations from the infrared through the X-ray to constrain the properties of disk winds in luminous quasars. The effectiveness of radiative launching is particularly sensitive to the hardness of the quasar continuum; X-ray-loud quasars are unlikely to have strong winds. With the large quasar samples available from the Sloan Digital Sky Survey combined with the excellent sensitivity and growing size of the *Chandra* and *XMM-Newton* archives, the role of the high energy continuum in influencing the disk wind can now be explored in detail.



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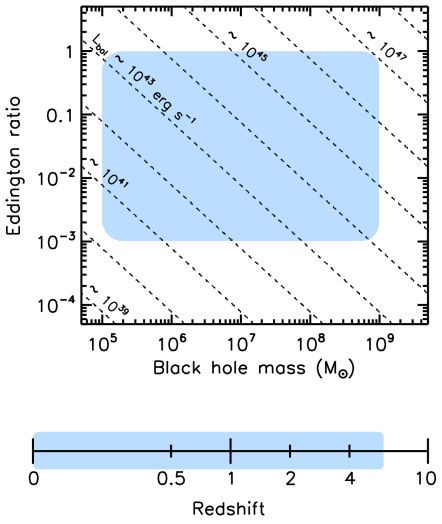
Detailed simulations of feedback

Dr Daniel Proga | University of Nevada, Las Vegas
dproga@physics.unlv.edu

Abstract

I review the results from multi-dimensional, time-dependent simulations of gas dynamics in AGN. I will focus on two types of outflows powered by radiation emitted from the AGN central engine: (1) outflows driven from the innermost part of an accretion disk and (2) outflows driven from a large-scale inflow that is likely the main supplier of material to the central engine. I discuss the relevance of both types of outflows to the so-called AGN feedback problem. However, the AGN feedback should not be considered separately from the AGN physics. Therefore, I also discuss the issue whether the properties of the same outflows are consistent with the gas properties in broad- and narrow-line regions.



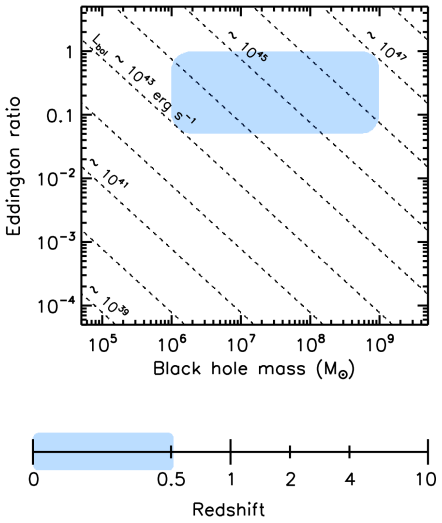
Notes

Ultra fast outflows from AGN and their role in feedback

Dr James Reeves | Keele University
jnr@astro.keele.ac.uk

Abstract

New observations of bright type I AGN with *Chandra*, *XMM-Newton* and *Suzaku* are now revealing the presence of high velocity and high ionisation outflows, likely originating from an accretion disk wind. Here I present the observational evidence for such winds in different types of AGN (e.g. Seyfert 1s, quasars, radio-loud AGN). Their likely location, geometry and covering fraction will be discussed and whether such outflows can make an energetically significant contribution towards feedback, in terms of regulating the growth of the galaxy bulge and the central supermassive black hole.



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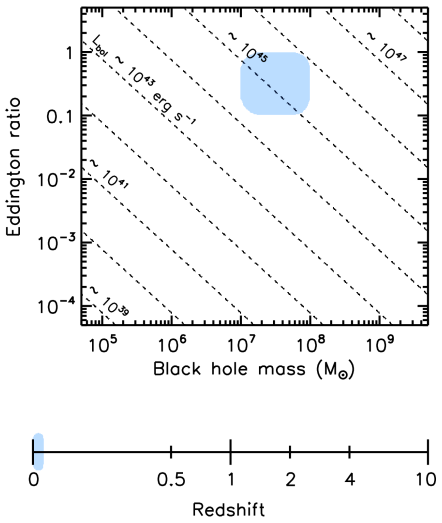
Do AGN Outflows Cease Star Formation? A New Technique Based on Ultradeep Chandra HETG Observations of NGC 1068

Dr Daniel Evans | Massachusetts Institute of Technology
devans@space.mit.edu

Abstract

AGN outflows are widely invoked as the key mediators between the co-evolution of black holes and their host galaxies. Yet, the key question remains: do the outflows actually deliver enough power to their environments to alter evolution in a meaningful way? To address this, we present results from a new 440-ks Chandra HETG GTO observation of the kpc-scale ionization cone in the canonical Seyfert 2 galaxy NGC 1068. We perform the first spatially resolved, sub-arcsecond scale, high-resolution X-ray spectroscopy of an AGN environment, and use the sensitive line diagnostics offered by the HETG to measure the outflow rate, ionization state, density, and temperature at discrete points along the ionized NLR. We investigate evidence for any velocity gradients in the outflow, and describe our next steps in modeling the NLR as a multiphase biconical outflow. Our results have key implications for the role of galactic-scale outflows in AGN as moderators of galaxy evolution.



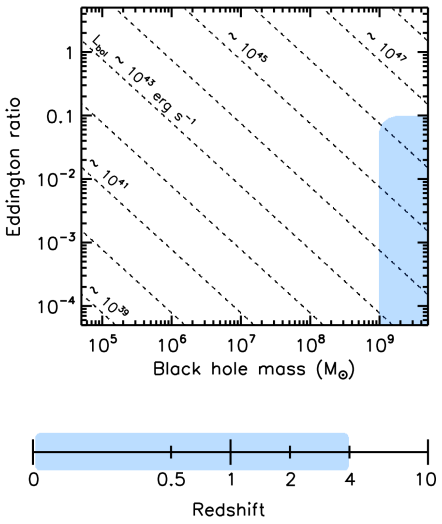
Notes

Quantifying the impact of AGN feedback on the evolution of massive galaxies

Dr Nicole Nesvadba | IAS Orsay
nicole.nesvadba@ias.u-psud.fr

Abstract

I will report on our observations of a unique sample of 50 powerful radio galaxies at z≥2 with the imaging spectrograph SINFONI on the VLT, where we find energetic outflows of up to 10^{10} $M_{\odot}$ of ionized gas with kinetic energies near the binding energy of the host galaxy, and extending over up to 50 kpc. Cold molecular gas masses in the same galaxies do not exceed the masses of ionized gas suggesting that a large fraction of the ISM is participating in the outflow. On the example of a nearby radio galaxy, I will outline how the mechanical energy injection of the radio jet may influence the conditions of the multiphase interstellar medium of the host galaxy (in particular the molecular gas) and ultimately star formation.



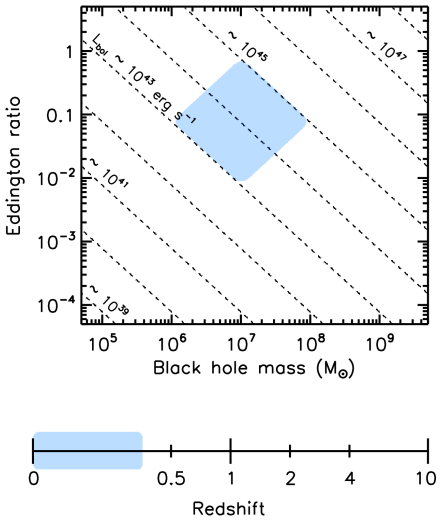
Notes

What is driving the feedback inducing, extended outflows around AGNs?

Dr James Mullaney | Durham University
j.r.mullaney@dur.ac.uk

Abstract

Recent integral field studies of high redshift ($z \sim 2$) AGNs have provided convincing evidence that both radio-loud and radio-quiet quasars are capable of producing energetic outflows extending across kiloparsec scales. This has been interpreted as the long sought-after evidence of ongoing AGN feedback that is a key ingredient of all leading galaxy formation models. However, due to the strong selection effects associated with the study of AGNs in the high redshift Universe, ubiquitous these extended outflows are among the general AGN population. Nor is it clear what the predominant driving mechanism powers these outflows (i.e., mechanical [radio jets] or radiative). I will describe how we have recently been using a homogeneous sample of SDSS selected AGNs to address these concerns. We find strong evidence that at least 30% of the most luminous AGNs show signs of potential, large scale outflows, many of which are radio quiet systems, suggesting that radio jets may not be an essential requirement for feedback inducing outflows.



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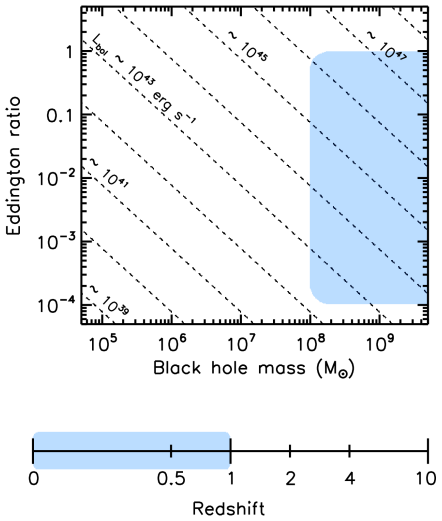
Radio-loud AGN feedback: how and when does it work?

Dr Martin Hardcastle | University of Hertfordshire
m.j.hardcastle@herts.ac.uk

Abstract

I will discuss the interaction between radio-loud AGN and the hot phase of the IGM/ICM, concentrating on what we know about how the AGN activity is triggered and what evidence we have for true “feedback” between the AGN and its environment.



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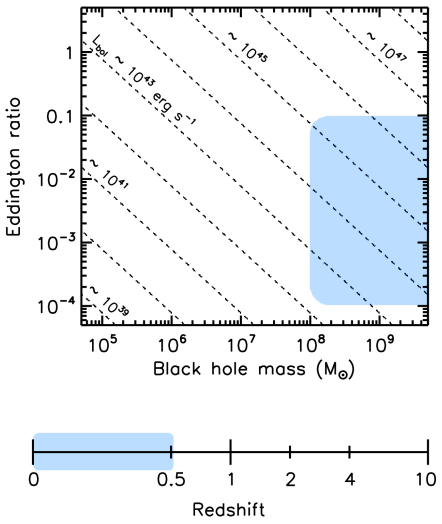
Are radio AGN powered by accretion or black hole spin?

Dr Brian McNamara | University of Waterloo
mcnamara@uwaterloo.ca

Abstract

X-ray observations have shown that star formation fueled by gas condensing from the hot atmospheres of galaxies and clusters is being suppressed by feedback from active galactic nuclei (AGN). But how feedback operates, and how radio AGN are powered are both poorly understood. I will discuss the possibility that AGN in clusters are powered by rapidly-spinning black holes, and I will suggest a mechanism that may be able to tap spin power through feedback. If instead, AGN in clusters are powered by accretion of molecular gas, I will show that AGN power is essentially decoupled from the host galaxy's gas supply. I will discuss a number of powerful AGN residing in relatively gas-poor galaxies that present a challenge to the classical accretion picture of AGN.



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Poster Programme Abstracts

Monday, 26th July – Thursday, 29th July 2010

The evolution of the hard X-ray luminosity function of AGN

Dr James Aird | UCSD
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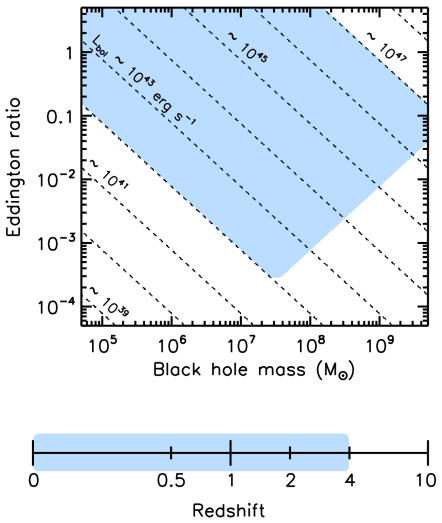
Abstract

Determining the distribution and evolution of accretion activity in Active Galactic Nuclei (AGN) throughout the history of the Universe, traced by the luminosity function, is essential to constrain models of supermassive black hole formation and growth, and their co-evolution with galaxies. I will present new results on the evolution of the X-ray luminosity function (XLF) of AGN using contemporary Bayesian statistical techniques and carefully accounting for selection effects, incompleteness, and uncertainties in photometric redshifts. In contrast to previous work, we find that the XLF retains the same shape at all redshifts, evolving only in luminosity and overall density. Our results shed new light on the distribution and evolution of the accretion activity of supermassive black holes, indicating the same physical processes drive AGN triggering and fuelling over the lifetime of the Universe.

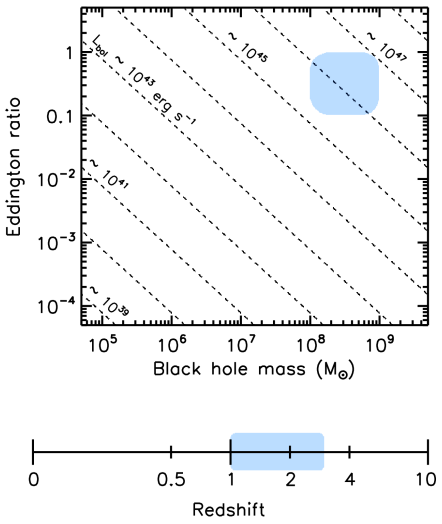


NIR spectroscopic survey of obscured AGNs at $z \sim 2$

Dr Masayuki Akiyama | Astronomical Institute, Tohoku University
akiyama@astr.tohoku.ac.jp

Abstract

In order to reveal statistical properties of obscured AGNs in the peak epoch of QSO activities, i.e. $z \sim 2$, we are conducting NIR spectroscopic surveys of optically-faint X-ray sources using unique NIR MOS instruments of Subaru, MOIRCS and FMOS. NIR spectroscopic surveys revealed a large number of obscured AGNs in the redshift range as expected from photometric redshift estimations. In order to unveil the further obscured populations of AGNs at similar redshifts, we are proposing a NIR spectroscopic survey of photometrically selected galaxies at z$\sim$ 2. Such observational plan will be introduced as a future prospect.

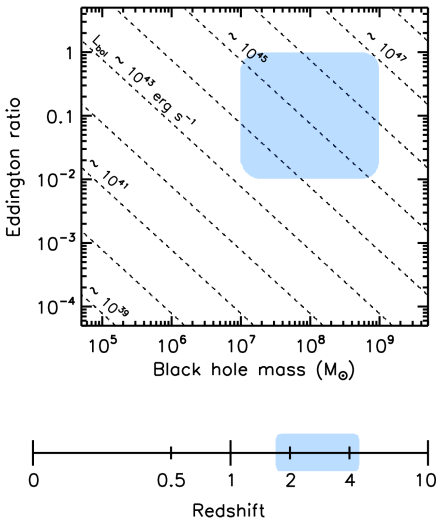


A dramatic increase in the fraction of broad absorption line quasars coincident with the epoch of rapid black hole growth

Mr James Allen | Institute of Astronomy, Cambridge
jta@ast.cam.ac.uk

Abstract

Broad absorption line quasars (BALQSOs) offer an opportunity to directly trace the kinematics of quasar outflows. The presence of outflows is expected to be intimately linked to the fuelling rate and Eddington ratio of the central black holes. I will present results from an analysis of a new catalogue of BALQSOs, which uses the novel technique of non-negative matrix factorisation to generate the most reliable continuum fits produced to date. Extensive tests have quantified the completeness of the catalogue as a function of various physical and observational parameters. The resulting redshift dependence of the intrinsic BALQSO fraction shows a dramatic increase where black hole growth is believed to be most rapid.



From WFC3/IR: The Quenching Effect of AGN Feedback on Host Galaxies

Dr S. Mark Ammons | University of Arizona
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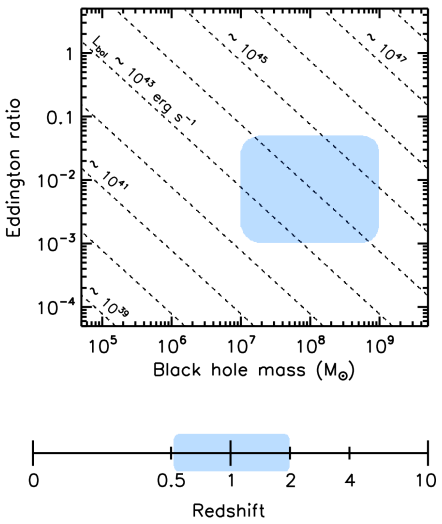
Abstract

I present results from two studies of the stellar populations of AGN hosts at z∼1–2 in the *Chandra* Deep Fields and COSMOS, with implications for the evolution of AGN host galaxies. AGN feedback may contribute to quenching of star formation by the expulsion or heating of cold gas, causing the host galaxy to evolve onto the red sequence (e.g., Di Matteo et al. 2005, Hopkins et al. 2006, Menci et al. 2008). We probe for the effects of AGN feedback on the stellar populations of ∼150 X-ray selected host galaxies using two diagnostics: Balmer/4000Å break strength in COSMOS and optical/NIR host colors from ACS and WFC3/IR imaging in GOODS. With specialized annular apertures, we limit host color contamination from central AGN emission to 0.02 mag in the UV. AGN obscuration, as measured with the X-ray hardness ratio, is expected to probe the geometric orientation of a dusty torus with respect to the line of sight. In some evolutionary scenarios, AGN feedback may disrupt this torus as well as quench star formation in the host galaxy, producing redder stellar populations in unobscured AGN hosts. *Abridged*



Implementation of AGN Feedback in Galaxy Formation: Spherical Tests of Bondi Accretion using SPH

Dr Paramita Barai | University of Nevada, Las Vegas
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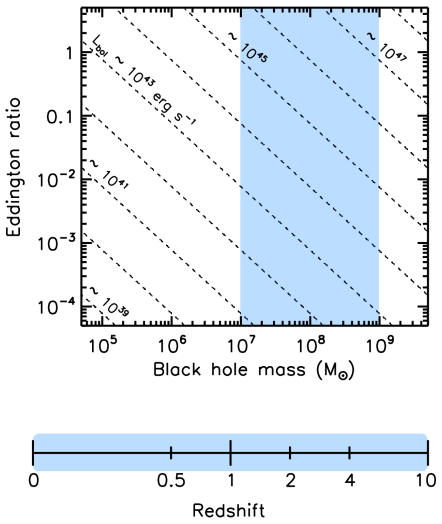
Abstract

We aim to numerically test the assumption, that the central massive BH of a galaxy accretes mass at the Bondi-Hoyle accretion rate (with ad-hoc choice of the alpha parameter value), made in previous studies of cosmological simulations including AGN feedback. We perform simulations of a spherically accreting system in the scale 0.1–50 pc, using the 3D SPH code Gadget-3. Our system consists of a spherical distribution of gas accreting onto a central BH (the Bondi problem), wherein we have studied how different gas properties and computational parameters affect the central mass inflow rate. We are currently including extra physics (namely heating by a central X-ray corona and gas cooling); eventually, we would simulate realistic BH accretion with accretion-disk geometry, including both inflows and outflows (which has been done previously using grid-based codes like ZEUS, but not with SPH). Our ultimate goal is to incorporate these small-scale results into large-scale cosmological simulations, and refine the prescriptions for AGN feedback. *Abridged*



PMAS-PPAK integral field spectroscopy of nearby Seyfert and normal spiral galaxies

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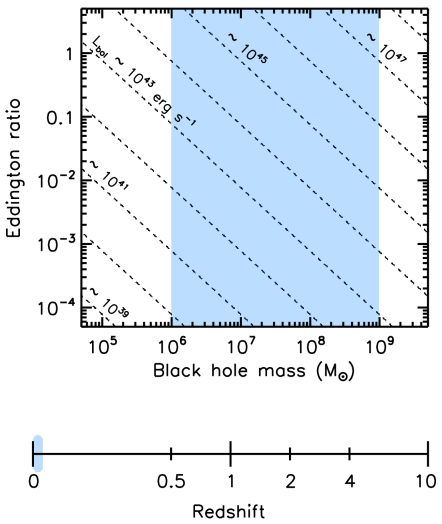
Abstract

We study emitting ionized gas of 4 carefully matched pairs of nearby Seyfert (NGC 5194, NGC 4579, NGC 4151, NGC 4138) and normal spiral galaxies (NGC 5055, NGC 3351, NGC 2985, NGC 3245) obtained with a large FOV (76 arcsec) PMAS-PPAK integral-field spectrograph (Calar Alto 3.5m telescope). Our data cover spectral range from [OII]3726Å ,3729Å to [SII]6717Å,6731Å and reach spectral resolution 3Å for H_α and [NII] (11Å elsewhere). We focus at studying gas kinematics (rotation, inflows, outflows), diagnostic line ratios (AGN vs. hot stars), electron density, extinction and star formation rate in a few central kpc. This is meant to be a PMAS-PPAK pilot 3D spectroscopy study with a view to extend the sample and characterize systematic differences between these two classes of galaxies on scales of tens of parsecs to a few kpc, and relate them to the growth of the central supermassive black holes.
This poster also includes a contribution from I Stoklasova on Seyfert galaxy kinematics



Assessing obscured quasars at $z \sim 2$

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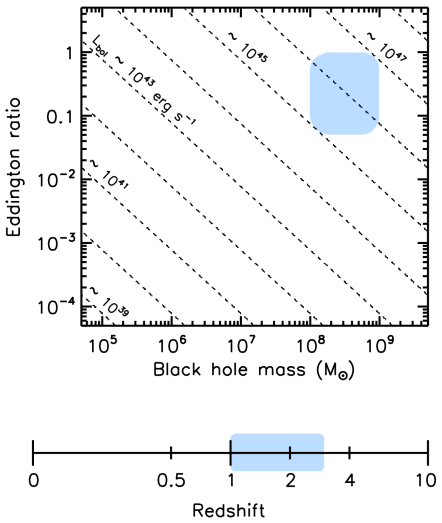
Abstract

To explain many of the characteristics of modern-day galaxies, successful models of galaxy formation and evolution must typically invoke some form of self-regulated heating or feedback. Although the precise physical mechanisms by which such feedback can be transferred from its sources to sinks is still a matter of debate, powerful active galactic nuclei remain one of the most obvious and viable candidates. Among AGN, Compton-thick quasars are considered one of the best possibilities for harnessing the AGN power as feedback for galaxy evolution, but have been to date relatively difficult to find. I will present results on our current estimates of the obscured quasar number density from deep X-ray and IR spectroscopic surveys.



The Environments of AGN at High Redshift ($1.0 < z < 2.0$)

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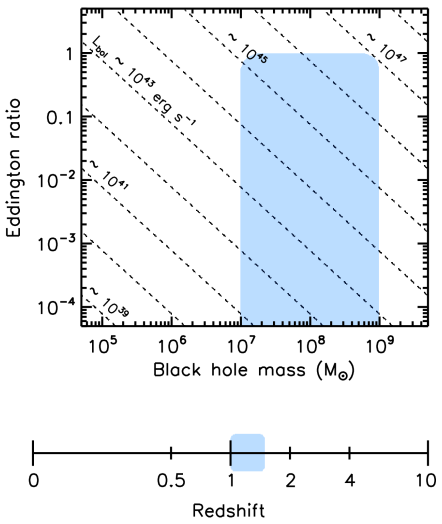
Abstract

In the local Universe it is well-established that while radio-loud AGN live in overdense environments, more typical X-ray selected AGN appear to randomly trace the galaxy distribution. Using recent data from the UKIDSS Ultra-Deep Survey I find evidence for a significant change in the environments of AGN at high redshift ($z > 1$). By cross-correlating with the positions of tens of thousands of K-selected galaxies, I find that both X-ray and radio-selected AGN reside in highly overdense environments at $1.0 < z < 1.5$, consistent with inhabiting very massive dark matter halos. The neighbours of both types of AGN are preferentially old, passive galaxies rather than starforming systems, providing an insight into the lifecycle of massive galaxies at these redshifts. I will also present new results from the UDSz redshift survey, using stacking techniques to search for evidence of AGN-driven winds or outflows (using the MgII interstellar absorption feature). Preliminary results suggest that such winds are more prevalent in inactive, passive galaxies. We speculate on the likelihood that AGN winds play a major role in driving the colour bimodality of galaxies, which appears to be established in the redshift range $1 < z < 2$.



Resonant stars/disk interaction: implications for MBH evolution

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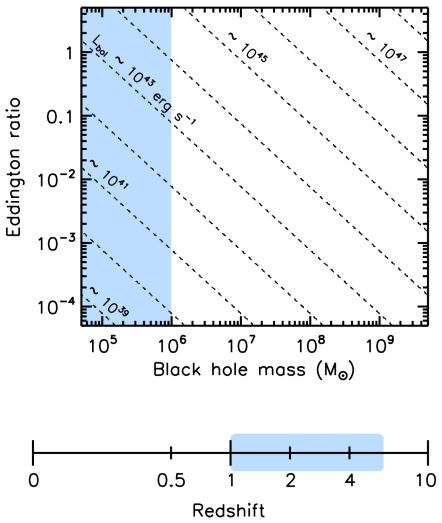
Abstract

Accretion disks around massive black holes (M_{BH}) in active galaxies can exhibits warps, as observed in the maser disk of NGC 4258. The physics driving the warp are still debated. We propose a new warping mechanism: resonant torquing of the disk by stars in the dense cusp around the M_{BH}. We show that resonant torquing can induce such a warp and can affect the accretion rate of matter flowing into the M_{BH}. The resonant torques, by acting on the disk, can also modify the M_{BH} spin, and therefore its evolution.



Feedback in action in a $z \sim 1.6$ XMM-COSMOS Obscured QSO

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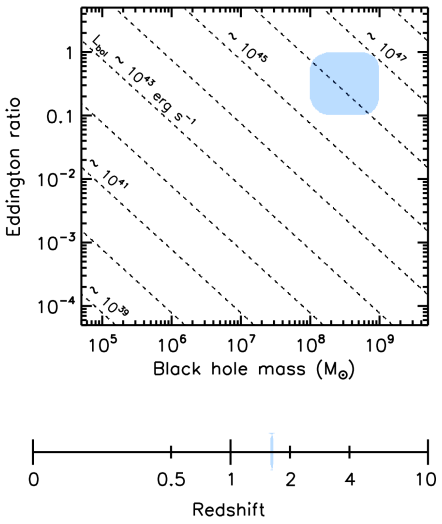
Abstract

We present the spectral energy distribution of XID 2028, a high-z ($z \sim 1.6$) obscured QSO possibly caught in a transition stage from being starburst dominated to AGN dominated. XID 2028 is one of the brightest XMM-COSMOS sources, with an unabsorbed X-ray luminosity L_X 10^{45} erg/s and substantial X-ray absorption ($N_H \sim 10^{22}$ cm^{-2}), i.e. a Type 2 QSO. The optical and IR colors further classify this source as an Extremely Red Object (ERO, $R - K = 6.1$) and Dust Obscured Galaxy (DOG, MIPS/Opt > 1000). This source presents both strong optical AGN emission lines ([NeV] doublet) and Star Formation features ([OII]). Moreover, evidence of outflowing materiala at $v \sim 300$ km s^{-1} is also clearly detected from the blueshifted MgI and MgII complex absorption. The overall SED is well fitted by templates resulting from theoretical models for AGN and galaxy co-evolution developed for $z \sim 2$ DOGs (i.e. Narayanan et al. 2009). $L_{\rm bol}$ is $\sim 2 \times 10^{46}$ erg s^{-1}; assuming that XID 2028 is hosting a radiatively efficient ($L/L_{Edd} \sim 0.1$–1) BH, as expected for objects in the transition phase, the BH mass is of the order of 10^8–10^9 $M_\odot$, in agreement with what can be inferred from the host galaxy mass from the M_{BH}–$M_{\rm Bulge}$ relations ($\sim 5 \times 10^8$). *Abridged*



The disappearance of the Green Valley: AGN host galaxy populations at $z \sim 1$

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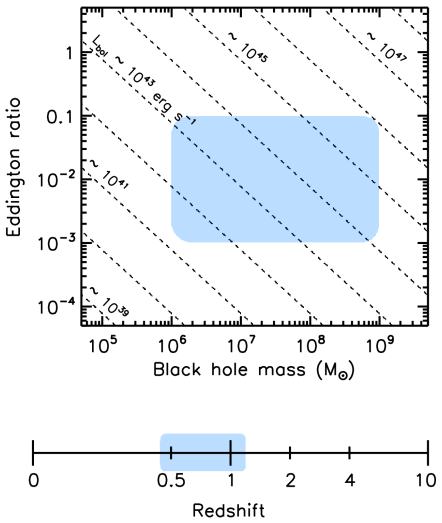
Abstract

AGN host galaxies at $z < 1.5$ have intermediate host galaxy colors, an observation which is often used as support for the black hole growth driving galaxy evolution from blue-star-forming phase to a red-passive phase. However, recent results suggest that the green valley is composed of dusty objects, rather than a transition population. We confirm these results and show that the AGN host galaxy population is actually bi-modal: with roughly half of the observed AGN host galaxy colors at $z \sim 1$ consistent with older metal-rich stellar populations, and the rest consistent with young stellar populations many of which show evidence of dust obscuration. We extend this analysis through detailed SED fitting and show that once corrected for dust, the AGN host galaxy colors cleanly separate into two populations, one blue and one red.



Exploring structure around submm-bright QSOs

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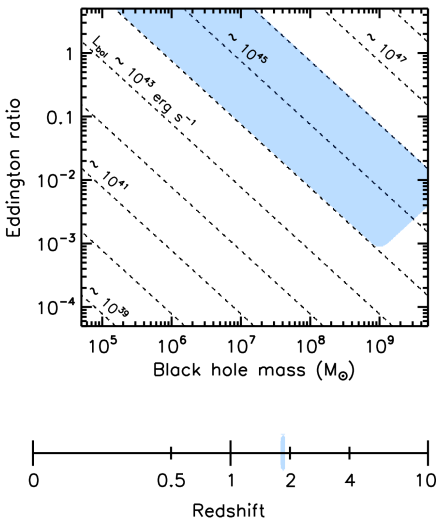
Abstract

We have assembled a sample of X-ray and submm luminous QSOs which are therefore both growing their central black holes through accretion and forming stars copiously. SCUBA maps have shown that they are also surrounded by submm source overdensities, placing them in the centres of high density peaks of the $z \sim 2$ Universe, probably giving rise to massive ellipticas like those seen in the local Universe. We have explored in detail the field around one of those QSO, using photometric redshifts and SED fitting, to show that the submm sources are indeed associated to the QSO, to estimate their star formation rates, and their stellar and gas masses, and to investigate the presence of active nuclei in their centres. *Presented by M Page*



No merger-quasar connection since $z \sim 1$

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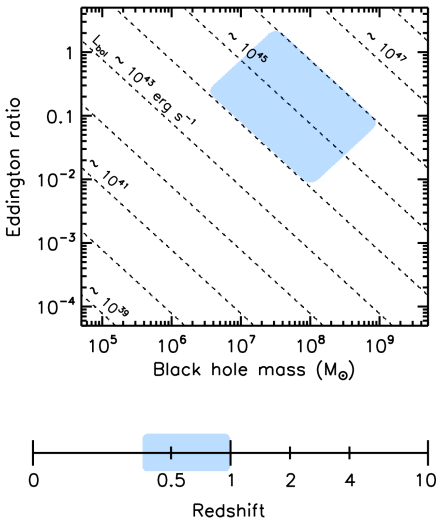
Abstract

What is the relevance of major mergers and interactions as triggering mechanisms for AGN activity? This project tackles this longstanding question as follows: We study a sample of 140 AGN host galaxies over $z \sim 0.3$–1.0 with high-resolution HST/ACS imaging from the COSMOS field. We perform a visual analysis of their morphologies, looking for signatures of interactions and/or mergers that could potentially be related to the AGN fueling/triggering. To establish the significance of any distortions present in our AGN hosts, we compare them with a matched control sample of inactive galaxies from the same dataset. After carrying out this analysis with 10 independent human classifiers, we find no enhanced merger rate for the AGN hosts over the inactive galaxies. Our findings provide direct evidence that, since $z \sim 1$, secular evolution and minor interactions take the lead over major merging as the primary mechanisms for triggering AGN activity.



A runaway BH in COSMOS: GW or slingshot recoil?

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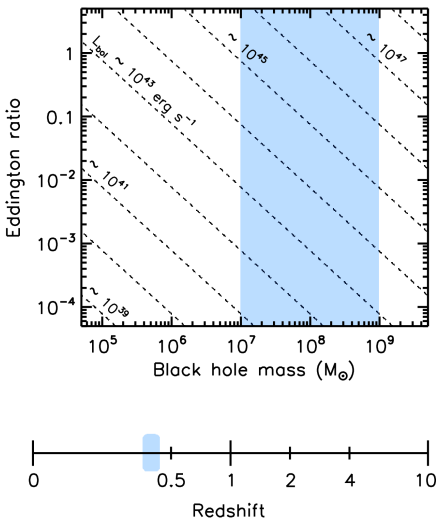
Abstract

We present a detailed study of a peculiar source detected in the COSMOS survey at $z = 0.359$. Source CID-42 is unique in three specific ways. First, it presents two compact sources resolved in the optical HST image embedded in the same galaxy (2.46 kpc apart). Second, a large (> 1000 km s^{-1}) velocity offset between the narrow and broad components of H_β has been measured in 3 optical spectra from the VLT/VIMOS and Magellan/IMACS instruments. Third, CID-42 is the only X-ray source in COSMOS having in its X-ray spectra a strong redshifted absorption iron line, and an iron emission line, drawing an inverted P-Cygni profile. The absorption line is variable in energy and the absorber has to be highly ionized, in order not to leave a signature in the soft X-ray spectrum. That these features occur in the same source is unlikely to be a coincidence. We envisage two possible explanations: (1) a gravitational wave recoil BH, caught 1–10 Myr after merging, (2) a Type 1 / Type 2 system in the same galaxy where the Type 1 is recoling due to slingshot effect produced by a triple BH system.



Heavily Obscured AGN in the deep XMM survey in the CDFS

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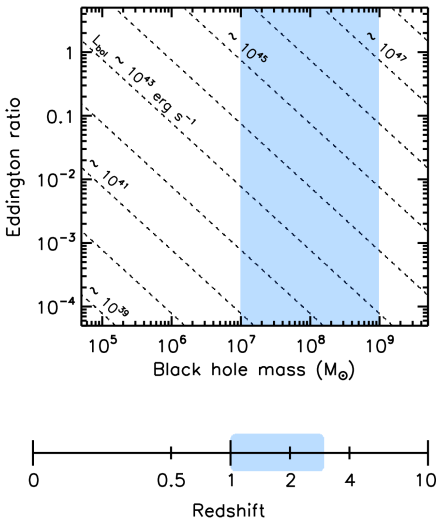
Abstract

The main secientific goal of the ultra-deep (∼3 Ms) *XMM-Newton* survey in the *Chandra* Deep Field South (CDFS) is the detection and the spectral characterization of the most obscured Supermassive Black Holes (SMBH) at cosmological distances (up to z∼1–2). Together with the large body of deep multiwavelength observations in the CDFS, XMM observations will allow us to investigate the role of heavy obscuration in the growth and evolution of SMBHs and the role played by Compton Thick absorption as a feedback mechanism. At the time of writing about 50 sources were detected with more than 300 pn counts in the 0.5–8 keV band. We will present the X–ray spectral analysis of a sizable sample of obscured and candidate Compton Thick AGN in the CDFS making use of about 1.5 Ms of XMM data. The X–ray data will be complemented by multiwavelength observations to build broad band Spectral Energy Distribution (SED). Implications for the SMBH growth and evolution will be also discussed.



Modelling quasar accretion disks from Hα emission

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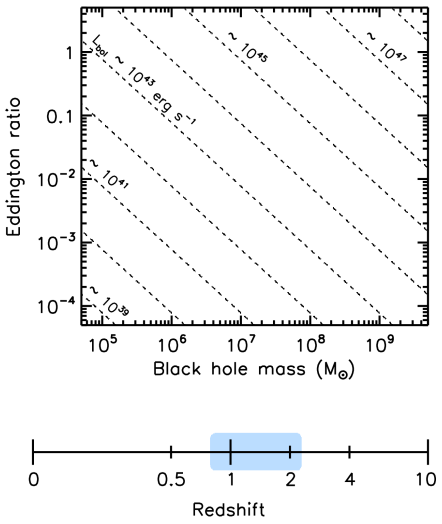
Abstract

The complex Hα emission of a sub-sample of 19 $0.8 < z < 2.3$ quasars was fitted with a range of models, some including a component arising from a flattened, extended accretion disk. Comparing the models using the Bayesian evidence, 95% of the sample have spectra comprising more than one broad component of emission, and 95% of the sources are found to be compatible with the presence of an optically-emitting accretion disk. The fitted parameters of the highest evidence fits are used to investigate (i) How the velocity offsets between the broad-line and narrow-line gas change with redshift (ii) Whether there is misalignment between the disk angle and the angle of the jet retrieved from the radio spectral energy distribution, which may be expected in the younger sources if the jets were triggered in the last $\sim 10^7$ to 10^8 years by coalescence of black holes following a galaxy merger



The prevalence and effects of AGN in clusters and ellipticals

Dr Robert Dunn | Excellence Cluster Universe
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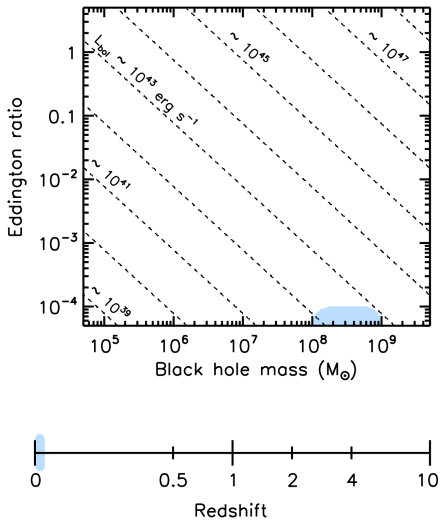
Abstract

Using well defined samples of galaxy clusters and elliptical galaxies we will present results on the prevalence of AGN in these objects. I use high resolution radio and X-ray observations to determine the existence of AGN in these objects, and their effect on their surroundings. Combining the BCS and B55 galaxy cluster samples we show that AGN are preferentially found in those systems with cool cores, and clear cavities have only been detected when the cooling time is < 1.2 Gyr (though the detectability of these cavities is not well determined). In a sample of nearby, massive X-ray bright elliptical and S0 galaxies, where all 18 galaxies have VLA radio and *Chandra* X-ray coverage, we detect nuclear radio emission from 17/18 (94%) of the galaxies and extended radio emission from 10/18 (55%). Increasing the sample size to 42 galaxies by lowering the X-ray flux limit we find evidence for nuclear radio emission in at least 81% of these galaxies.



Cosmic Evolution of Mass, Size, and Velocity Dispersion for ETGs

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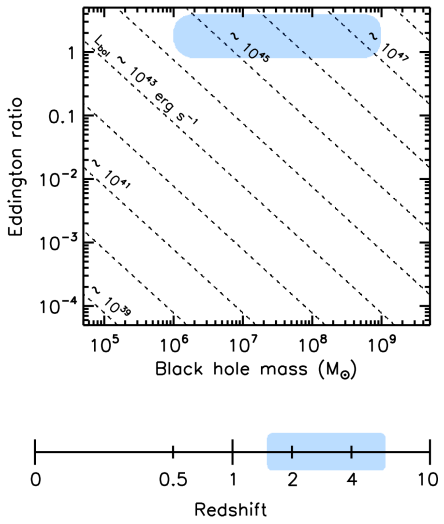
Abstract

Massive (stellar mass $M_\star > 3.0 \times 10^{10} M_\odot$), passively evolving galaxies at redshifts $z > 1$ exhibit physical sizes smaller by factors 3–5 than local early type galaxies (ETGs) endowed with the same stellar mass. We show that small sizes are in fact expected on theoretical grounds, if dissipative collapse occurs. We find that observations of the mass functions of massive ETGs at high redshifts and studies of high redshift Brightest Cluster Galaxies constrain the mass increase to less than 40%, thus excluding dry minor mergers as responsible for most of the size evolution.We suggest that quasar activity, which peaks at redshift $z \sim 2$, can remove large amount of gas from central galaxy regions on a timescale shorter than the dynamical one, keeping the mass constant and triggering a puffing up of the stellar component; in this case the size increase goes together with a decrease of the central mass. In addition, the size evolution is expected to parallel that of the quasars and the inverse hierarchy, or downsizing,seen in the quasar evolution is mirrored in the size evolution. The fraction of compact high redshift ETGs critically depends on the timescale required to reach a new, expanded, equilibrium configuration. *Abridged*



X-ray properties of power-law sources in COSMOS and CDFS

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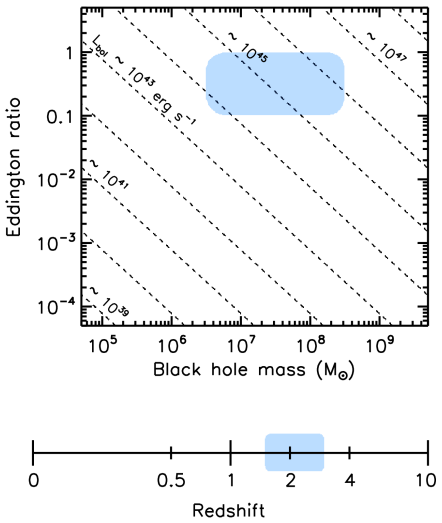
Abstract

We select sources with power law SEDs among BzK galaxies at $z = 1.5$–2.5 without a direct X-ray detection in COSMOS and CDFS, and study their X-ray properties, X-ray luminosities, obscuration through X-ray stacking. We find that they have hard X-ray band detection and column density greater than $\sim 10^{24}$ cm^{-2}, therefore they are heavily obscured AGN. We study their volume density and compare with model predictions for highly obscured and Compton thick AGN.



Zooming in on quasar accretion

Dr David Floyd | Anglo-Australian Oservatory & University of Melbourne
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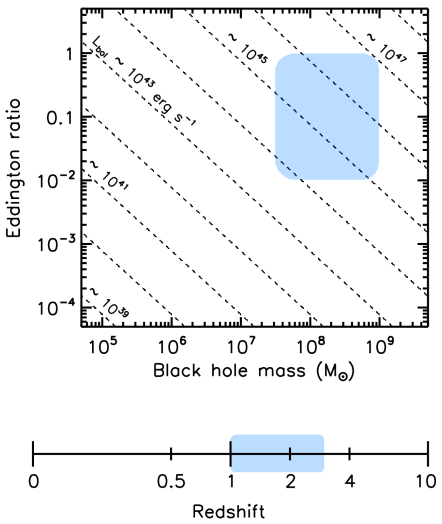
Abstract

Using serendipitously lensed quasars, we can determine the radial temperature profile of the central continuum emitting region, and examine the structure of the BELR, using a microlensing signature to obtain effective angular resolutions of micro to nanoarcseconds. I will present recent results from Magellan and the VLT that place the tightest constraints yet on the size of the quasar continuum emission region, and place interesting physical constraints on the accretion mechanism in these objects.



Lyα Blobs are powered by heating, not cooling

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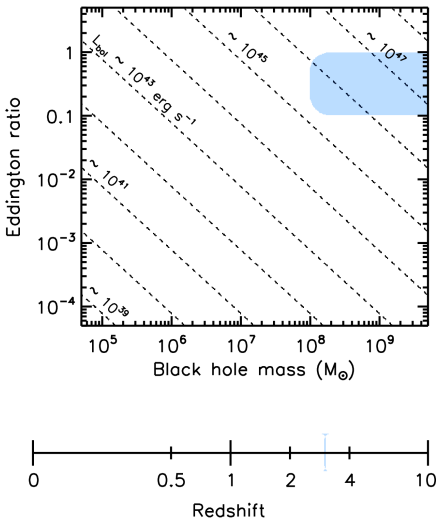
Abstract

We present the results of a 400ks *Chandra* survey of 29 extended Lyα emitting nebulae (LABs) in the z =3.09 proto-cluster in the SSA22 field. We detect X-ray counterparts with $L_{2-32\mathrm{keV}} \sim 10^{44}$ erg/s in five LABs, implying a large fraction of active galactic nuclei (AGN) in these objects. We show that the UV luminosities of the AGN are easily capable of powering the extended Lyα emission via photo-ionization alone. When combined with mechanical feedback, and the UV flux from a starburst component, we demonstrate that heating by a central source, rather than gravitational cooling is the most likely power source of LABs. We argue that all LABs could be powered in this manner, but that the luminous host galaxies could often be just below the sensitivity limits of current instrumentation, or heavily obscured. Finally, we report the non-detection of an extended X-ray component in any of the LABs studied. The resulting diffuse X-ray/Lyα luminosity limit implies there is no hot gas ($T \sim 10^7$ K) component in these gaseous halos,and also rules out inverse Compton scattering of cosmic microwave background photons,or local infrared photons, as a viable power source for LABs.



High-resolution spectroscopy of AGN outflows in 3C445 and MR2251-178.

Mr Jason Gofford | Keele University
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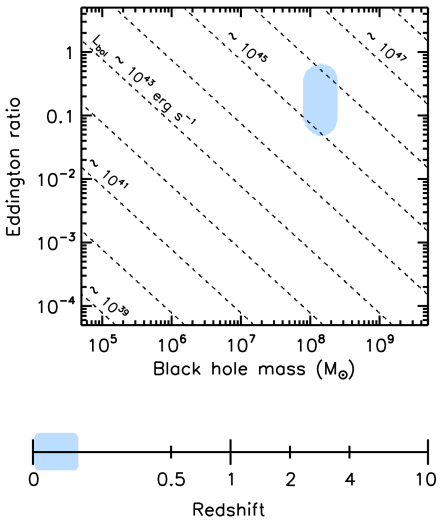
Abstract

My poster is investigating the prevalence of fast outflows in both radio-quiet and radio-loud AGN. I present composite *Chandra* and *Suzaku* spectra of two objects: MR2251-178, a radio-quiet Seyfert 1 at $z = 0.064$ and 3C445, a highly inclined to line of sight (60 deg) broad line radio galaxy (BLRG) at $z = 0.0562$. I show that both sources exhibit the characteristic features generally attributable to AGN outflows: In the case of MR2251-178, blue-shifted absorption features with $v = 0.06$c are seen, likely attributable to outflow from an accretion disk. In 3C445 the absorption region itself is seen to be blue-shifted. This is attributed to the source being viewed along the axis of an AGN wind. The likely location, geometry and energetics are also discussed as well as the implications for the unified scheme.



A Sample of Radio Galaxies Spanning Three Decades in Radio Luminosity - The Fundamental Plane and Star Formation Histories

Mr Peter Herbert | University of Hertfordshire
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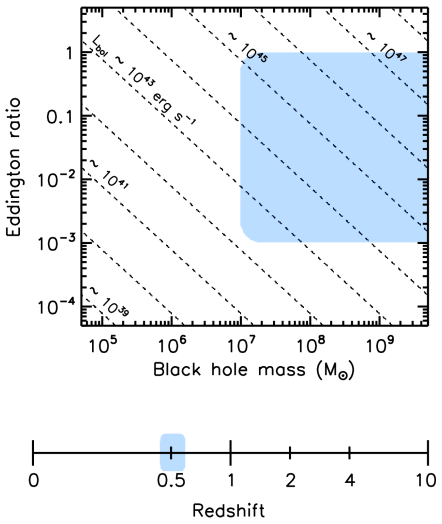
Abstract

We present the results of our complete investigation of the host galaxies and environments of a sample of radio galaxies spanning a factor of 1000 in radio luminosity at a single cosmic epoch ($0.4 < z < 0.6$). We describe our investigations into the Fundamental Plane of $z \sim 0.5$ radio galaxies using deep spectroscopic data combined with the HST data from McLure et al. (2004). We find evidence for a $z \sim 0.5$ Fundamental Plane that is somewhat different to that observed in the local universe and discuss possible reasons for this discrepancy. We also find evidence of different star formation histories for high- and low-luminosity radio galaxies.



Clumpy accretion flows in active galactic nuclei

Miss Wako Ishibashi | ISDC, Geneva University, Switzerland
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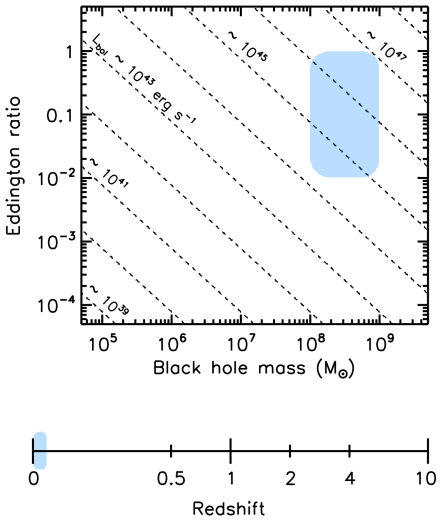
Abstract

We discuss the fuelling of the central black hole in active galactic nuclei in the framework of clumpy accretion flows. In this picture, shocks between elements (clumps) forming the accretion flow are at the origin of the conversion of gravitational energy into radiative energy, and at the same time provide a physical mechanism of angular momentum transport. A cascade of shocks is expected, with optically thick shocks giving rise to optical/UV emission and optically thin shocks accounting for the X-ray emission. We predict the typically observed range of X-ray to UV luminosity ratios (L_X/L_{UV}), and obtain a trend consistent with the alphaOX-LUV anticorrelation. We also derive a characteristic X-ray variability time scale within our model and compare it with the break time scale measured in the X-ray power spectral density (PSD). The model dependence of the variability time scale on black hole mass and accretion rate is in excellent agreement with the observational relation obtained by McHardy et al. (2006). X-ray variability properties are also closely related to X-ray spectral properties. In our picture, steeper spectra are associated with shorter characteristic time scales, which may account for the recently discovered spectral-timing correlation.



Growth of central supermassive blackholes and bulges due to bars and gas return from old stellar populations

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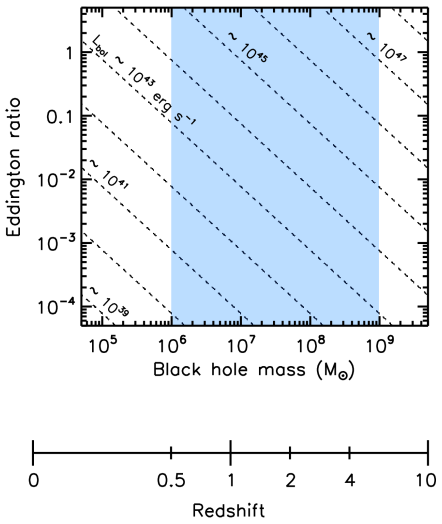
Abstract

We present new estimates of gas inflow rate into the central hundred parsecs of spiral and lenticular galaxies due to combined effects of bar-induced transport and gas return from intermediate and old stellar populations of disk, bulge and central star clusters. N-body simulations are used while the time-dependent scheme for stellar mass-loss over the Hubble time is updated to take into account recent progress in measuring star formation rate in galactic disks as well as recent developments in the stellar IMF theory.



BH mass and Bulge Luminosity Relation in Nearby Type I AGNs

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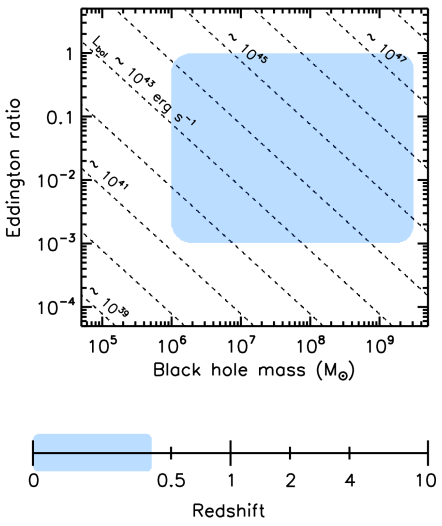
Abstract

We present the low-z M_{BH}–$L_{\rm bulge}$ relation of broad-line AGNs by analyzing a sample of 237 low-z (< 0.35) AGNs. We derive M_{BH} from published optical spectra assuming a spherical broad-line region, and L_{bul} from detailed two-dimensional decomposition of archival optical HST images. We find that our entire sample roughly follows the M_{BH}–$L_{\rm bulge}$ relation of inactive galaxies, but the zero-point is offset by ~ 0.5 dex toward lower BH mass. We show that Eddington ratio and galaxy morphology is the primary parameters that dominantly give rise to the systematic offset to the M_{BH}–$L_{\rm bulge}$ relation. Finally, the radio power is strongly correlated with the morphology of host galaxy.



Diffuse gas cooling onto satellite galaxies and its relevance on the black hole growth

Mr Taysun Kimm | University of Oxford
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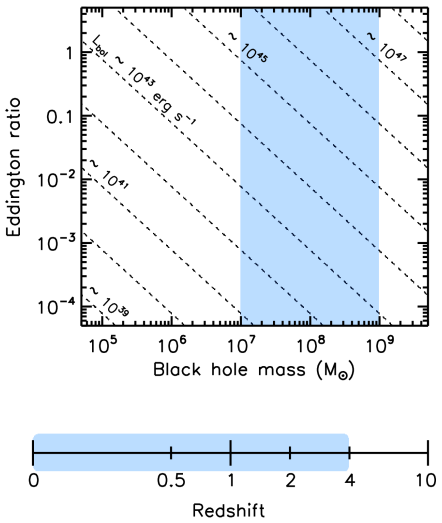
Abstract

Observational evidence that galaxy and supermassive black hole formation and evolution are tightly coupled together has become overwhelming. Theoretical arguments can easily be made as to why AGN feedback should regulate star formation. However, it is yet unclear how, to what extent, and when in the life of a galaxy such an interplay occurs. We will present preliminary results of the first attempt to shed light on this complex issue using AMR cosmological simulations. More specifically, we discuss the problem of how much intermittent, sub-relativistic, AGN jets can alter the global star formation history of galaxies in the LCDM paradigm.



SED and emission line properties of the low redshift red 2MASS AGN

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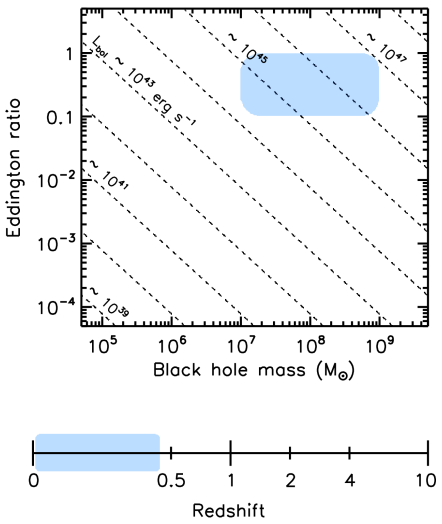
Abstract

The low-redshift red ($J–K_s > 2$) 2MASS AGN include predominantly moderately obscured ($N_H <$ few$\times 10^{22}$ cm^{-2}), inclined sources that are viewed through an outflowing accretion disk wind, edge of a dusty torus or edge-on host galaxy. The obscuration/inclination offer the opportunity to see/study weaker emission components which are generally swamped by the direct AGN light, providing clues to fueling and outflows by directly observing the material responsible. The IR-to-X-ray spectral energy distributions (SEDs) of the red 2MASS AGN show significant contributions from reddening, host galaxy emission, and in a few, highly polarized objects, also from scattered AGN light. The L/L_{edd} ratio dominates the variance in the data as shown by PCA, which also distinguishes two sources of obscuration: the host galaxy and a circumnuclear absorption.



Tools for computing the AGN feedback: radio-loudness distribution and the kinetic luminosity function

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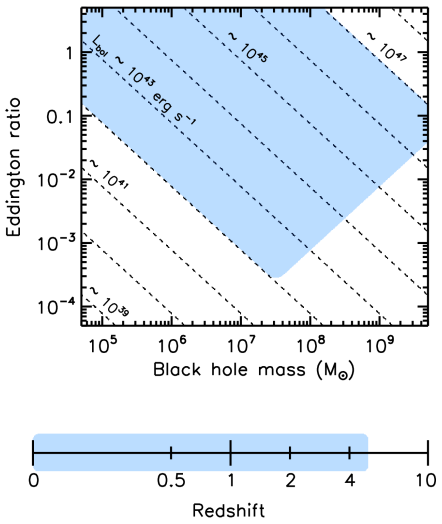
Abstract

We have studied the radio 1.4 GHz emission properties of ~ 1800 AGN collected from a compilation of complete hard X-ray selected samples. For the first time, it was possible to derive the complete probability distribution function of the ratio of the radio to intrinsic X-ray luminosity $R_X = \log[L_{1.4}/L_x]$. The probability distribution function of Rx has been functionally fitted as dependent from the un-absorbed X-ray luminosity and z. No significant difference was found between the radio properties of the X-ray absorbed and un-absorbed AGN. We derived the AGN 1.4 GHz luminosity function (LF) up to $z = 4$ by convolving our measured probability distribution function of the Rx ratio with previous estimates of the 2-10 keV X-ray AGN LF. This last estimate, by using previous measures of the conversion of the AGN radio power into kinetic energy, has allowed to derive the AGN kinetic LF and its evolution. It results that the value and evolution of the kinetic energy density is in agreement with the expectations of the last generation galaxy evolution models, where radio mode AGN feedback is required to quench the star formation in galaxies and slow down the cooling flows in galaxy clusters.



Stellar and AGN accretion disc alignments from SDSS data

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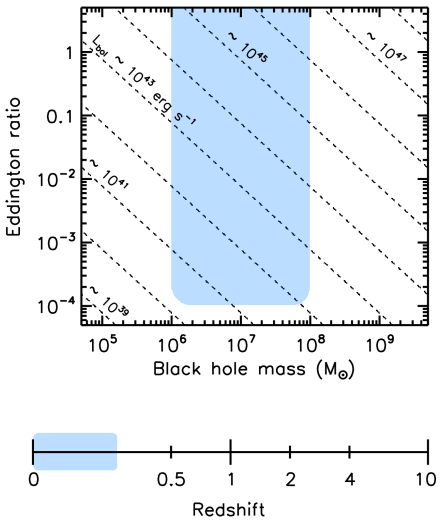
Abstract

We study the intrinsic shapes and orientations of type I and II AGN galaxies in the SDSS DR7, by studying the distribution of projected axis ratios of AGN hosts separated into spiral and elliptical galaxies. We define control samples of non-AGN galaxies that mimic the colour, luminosity and concentration distributions of the AGN population, taking into account the effects of dust extinction and reddening. Assuming that AGN populations have the same underlying shapes as their corresponding control samples we find that the type I AGN population is strongly biased toward face-on galaxies, while the type II AGN toward edge-on galaxies. Those tendencies could be explained with a central obscuring torus of ~ 40 degrees of azimuthal height located preferentially in the galactic plane. This points towards a geometrical alignment between optical light and accretion discs, putting important constraints on gas inflow and accretion processes. *Presented by C Lacey*



Misaligned discs and black hole growth

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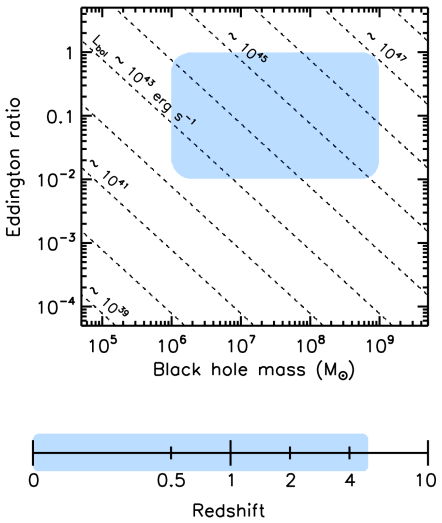
Abstract

I present evidence that, contrary to popular belief, AGN obscuration does not change with luminosity or redshift, and that obscured and unobscured AGN are present in roughly equal numbers. This is consistent with the "torus" actually being a warped disc caused by sporadic fuelling from random directions. This has implications for the growth of both the mass and spin of black holes. *Presented by M Elvis*



Large scale environments of nearby quasars

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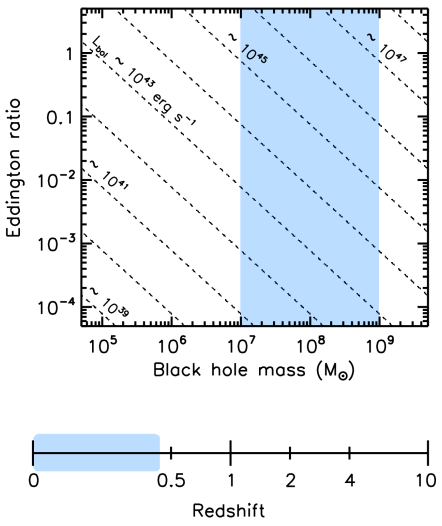
Abstract

According to the morphology-density relation, the properties of galaxies depend on their environmental density. Since the growth of black holes in active galactic nuclei may be an important phase in the evolution of all massive galaxies, the environments of these objects may provide us information about the evolutionary processes leading to different types of galaxies. We will present some of our latest results on the supercluster-scale environments of low-redshift AGN (quasars, BL Lac objects, Seyfert galaxies, and radio galaxies). The typical locations of AGN in the large scale structure of the universe may give us information about the evolution leading to activity. Our team has used the SDSS DR7 galaxy catalogs to determine luminosity density fields, which show density variations in supercluster scale. In Lietzen et al. (2009, A&A, 501, 145) we found that quasars avoid densest areas of the universe, but lie mostly at the outskirts of superclusters and in filaments. Our new results show that all AGN are usually at low-density environments, and there are small differences in the environments between the different types of AGN.



X-ray selected AGNs in the North Ecliptic Pole field

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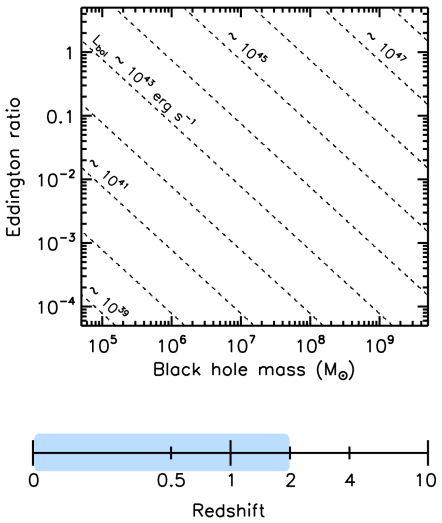
Abstract

XMM-Newton slews covers repeatedly the Ecliptic Poles regions, which have also been deeply studied with ground radio and optical telescopes and with other space X-ray and infrared telescopes like ROSAT, IRAS and Akari. We are producing a catalogue of all the sources detected when combining the information of all the slews covering a 9×9 degrees region around the North Ecliptic Pole. This combination of slews is 4 times deeper than a single slew. The flux limit F2-12keV is about 10^{-12}. We use all the available information to identify the AGNs of this field and study their properties.



Integral field spectroscopy of $z \sim 0.1$ QSO host galaxies

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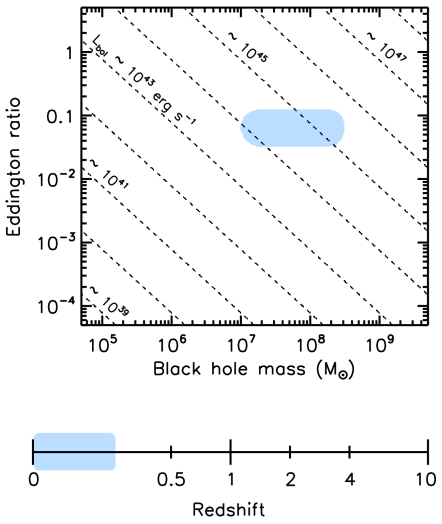
Abstract

We present the results of a programme of VLT/VIMOS Integral Field Spectroscopy of a volume limited sample of 19 luminous type 1 QSO host galaxies at $M_v \sim 23$ and redshifts $0.06 < z < 0.2$ aimed at investigating QSO triggering via host galaxy kinematics. Using this data, we produce QSO-subtracted 2D intensity maps and gas velocity fields for the host galaxies in the H_α and [OIII] emission lines. The observed velocity fields range from perfectly regular to very distorted, indicating that while interaction processes or distortion by inflows or outflows can influence the observed gas kinematics of some sources, for others, the presence of completely undisturbed velocity fields indicates that major merging can not be the dominant fueling mechanism for those QSOs. These results indicate that in this regime, secular mechanisms also can fuel QSO activity.



Controlling cooling flows and optimal AGN feedback

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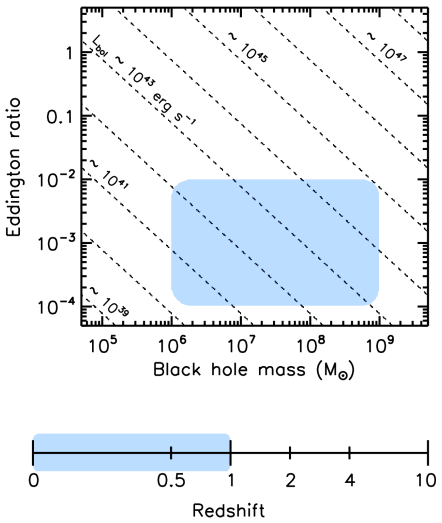
Abstract

AGN feedback in massive galaxies and galaxy clusters can be thought of as a naturally occurring control system which plays a significant role in regulating both star formation rates and the X-ray luminosity of the surrounding hot gas. Here, we investigate the application of standard techniques from optimal control theory and show that AGN feedback which acts to balance gas cooling and minimises the total energy output from the system necessarily occurs in the form of discrete and periodic events. Systems with stronger feedback experience proportionally more powerful heating events, but correspondingly smaller duty cycles. Comparison with observations suggests that stronger feedback occurs in less massive objects, e.g. elliptical galaxies, rather than galaxy clusters. A direct consequence of this effect is that AGN heating events are sufficiently powerful to expel hot gas from the gravitational potential of a galaxy, but not a galaxy cluster, which is consistent with theoretical explanations for the steepening of the $L_{\rm X} - T$ relation at temperatures below 1–2 keV.



The effects of radiation pressure on the absorption in the *Chandra* Deep Field populations

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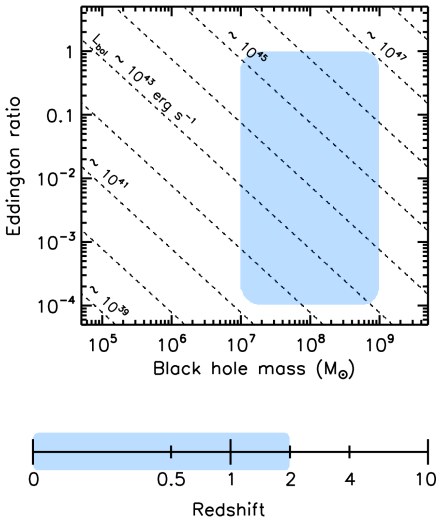
Abstract

The presence of gas around the central engine of an Active Galactic Nuclei (AGN) is a common feature of these type of objects. Recent work has looked at the effect of the dust component of the gas, and how it enhances radiation pressure in a way that dusty gas can have a lower effective Eddington limit than ionized gas. In this work, we use data from the 2 Ms exposures of the Chandra Deep Field North and Chandra Deep Field South surveys, to characterise the AGN in terms of their Eddington ratio (λ) and hydrogen column density (N_H). Their distribution is then compared with what is predicted when considering a coupling between dust and gas. We find that most of the AGN in our sample tend to be found at low Eddington ratios (typically $5\times10^{-4} < \lambda < 5\times10^{-2}$) and high N_H ($>10^{22}$cm^{-2}). Their distribution is in agreement with that expected from the enhanced radiation pressure model, avoiding the area where we would predict the presence of outflows. We also investigate the evolution with redshift of the AGN in the N_H vs λ plot, and what is their role in the behaviour of clouds in the galactic bulge.



The dependence of AGN activity on host and environment

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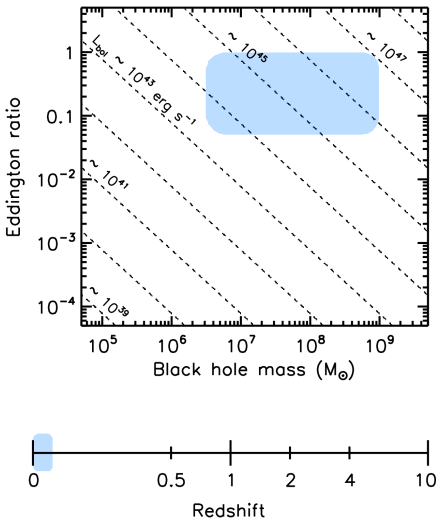
Abstract

The activity of a supermassive black hole (SMBH) depends on its mass, and on the environment in which it resides. We calculate the mass function of SMBHs from the SDSS, and show that the black hole mass function does not depend on the environment. We investigate the role of the black hole mass on the probability of having a radio and X-ray AGN, and conclude that the mode of AGN activity is not a function of the black hole mass but of the environment.



Borderline type-1 QSOs: WiFeS integral field spectroscopy of early-stage QSO candidates

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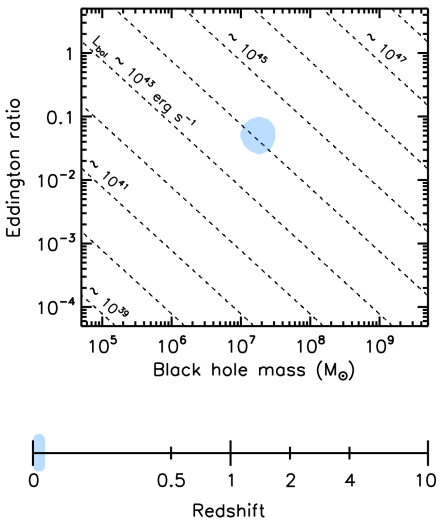
Abstract

I will present first results from optical integral field spectroscopy of 'borderline type-1 QSOs', using the new Wide Field Spectrograph WiFeS at the 2.3m telescope of the Australian National University at Siding Spring Observatory. The integral field spectroscopy is part of an ongoing multi-wavelength study of a sample of 99 nearby ($z < 0.06$) type-1 QSOs from the Hamburg/ESO survey which have 'borderline' luminosities at the classical Seyfert/QSO demarcation. The initial observation campaign targets a sub-sample of putative 'transition objects' between the infrared-luminous and the QSO phase, as identified by their intermediate colours in the IRAS two-colour diagram. The velocity maps and line diagnostics from the first WiFeS observations are discussed with focus on fuelling and feedback processes in these early-stage QSOs candidates.



Cluster - Quasar bound: 3C186 quasar in a massive cluster at high redshift.

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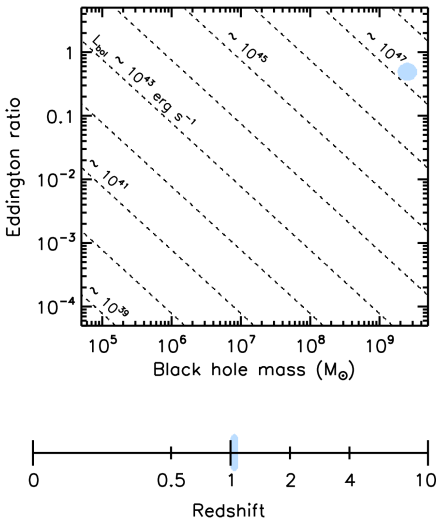
Abstract

We present *Chandra* observations of an X-ray cluster associated with the high-redshift, $z = 1.063$, compact-steep-spectrum radio-loud quasar 3C 186. The powerful quasar, $L \sim 10^{47}$ erg s^{-1}, is located at the core of the cluster. The temperature profile indicates that this is a cooling-core cluster with $kT = 3.11^{+0.91}_{-0.64}$ keV in the central cooler regions of the cluster. We measure a high cooling rate within the core of about 464^{+114}_{-78} $M_{\odot}$year^{-1}, and a cooling time of $7.1 \pm 1.4 \times 10^8$ years. The cooling gas is able to supply enough fuel to support growth of the supermassive black hole and to power the luminous quasar. The kinematic power of the central radio source is a factor of 10 lower than the quasar radiative power. We consider an idea that the radiation may provide greater heating in this cluster than the mechanical power of a radio source.



Observational constraints on the importance of radio-mode feedback in massive galaxy formation

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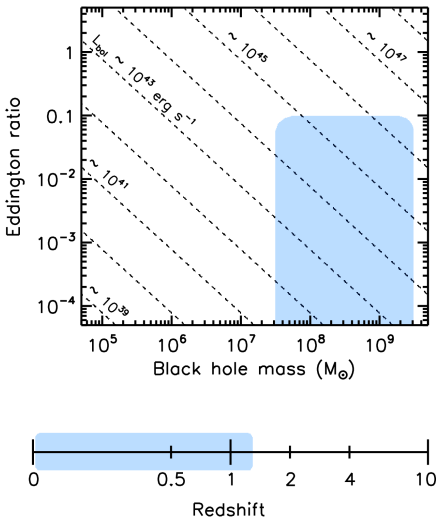
Abstract

Radio outflows of active galactic nuclei (AGN) are invoked in cosmological models as a key feedback mechanism in the latest phases of massive galaxy formation. However, from an observational point of view, the impact of such a mechanism on galaxy formation and evolution is still not well understood. I will present our recent results, based on radio-selected samples at low (SDSS/NVSS and 3CRR surveys; $z < 0.3$) and high redshifts (COSMOS survey, $z < 1.3$), that observationally test the importance of radio-mode feedback in massive galaxy formation (out to $z = 1.3$). 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 used data drawn from the COSMOS survey to study, for the first time, the cosmic evolution of weak radio AGN out to $z = 1.3$, which can directly be linked to the radio-mode feedback prediction in cosmological models.



The AGN content of infrared-selected luminous galaxies

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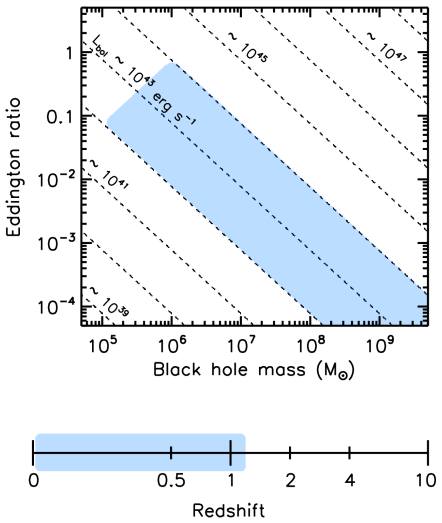
Abstract

We examine the AGN content and contribution in a sample of star-forming galaxies selected at 70μm, using *Chandra* X-ray and *Spitzer* infrared (3.6–160μm) data, as well as optical spectroscopy and photometry from the Deep Extra- galactic Evolutionary Probe 2 (DEEP 2) survey for the Extended Groth Strip (EGS) field. We find that although $\sim$ 13% of the sample shows signatures of an active nucleus, the primary energy source for all sources is star formation, with the AGN contribution being less than 10% on average. When compared to a sample of DEEP2 galaxies in the same redshift range and with similar optical colours, we find that the 70μm population is characterised by younger stellar ages and a higher AGN incidence, indicating that strongly star-forming populations might be key in studying the relationship between black hole and stellar growth.



Measurements of $M_{\rm BH}$ and $L/L_{\rm Edd}$ in High-Redshift type-I AGN

Mr Benny Trakhtenbrot | Tel-Aviv University
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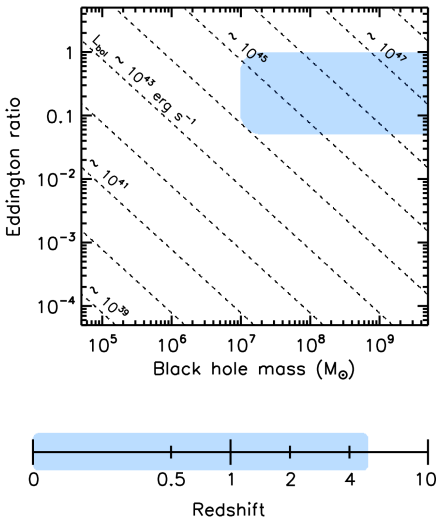
Abstract

I will present new measurements of $M_{\rm BH}$ and $L/L_{\rm Edd}$ in a well-defined, flux-limited sample of $\sim$40 type-I AGN at $z = 4.8$. The data were obtained in a combined VLT and Gemini effort, observing the MgII(2800A) line in the K-band. These new results are combined with the $z \sim 2.3 - 3.4$ sample analyzed in Netzer et al. (2007) and a large $z < 2$ SDSS-observed sample. We find a broad range of observed $L/L_{\rm Edd}$ in each of the samples, contrary to several theoretical expectations. Furthermore, many $z > 2$ sources have $L/L_{\rm Edd} < 0.4$. This may imply an extremely early epoch of fast mass accretion, to account for the observed $M_{\rm BH}$s.



Major Galaxy Mergers and the Growth of Supermassive Black Holes in Quasars

Dr Ezequiel Treister | IfA, University of Hawaii
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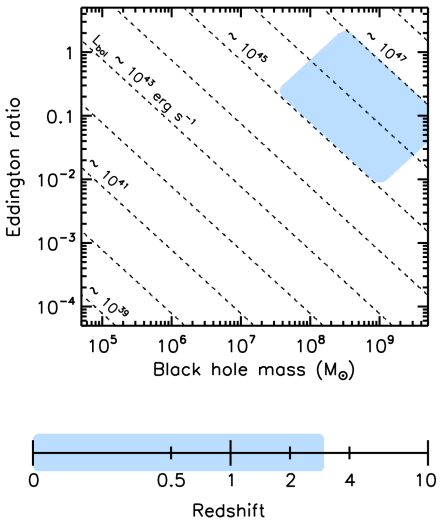
Abstract

Despite observed strong correlations between central supermassive black holes (SMBHs) and star-formation in galactic nuclei, uncertainties exist in our understanding of their coupling. We present observations of the ratio of heavily-obscured to unobscured quasars as a function of cosmic epoch up to $z \simeq 3$, and show that a simple physical model describing mergers of massive, gas-rich galaxies matches these observations. In the context of this model, every obscured and unobscured quasar represent two distinct phases that result from a massive galaxy merger event. Much of the mass growth of the SMBH occurs during the heavily-obscured phase. These observations provide additional evidence for a causal link between gas-rich galaxy mergers, accretion onto the nuclear SMBH and coeval star formation.



X-ray properties of Infrared luminous galaxies

Miss Katherine Tugwell | MSSL, University College London
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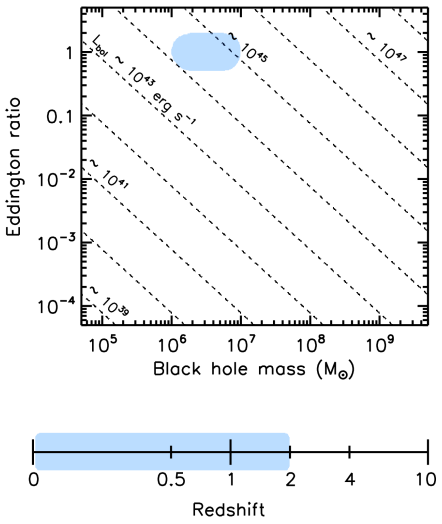
Abstract

We investigate the properties of 70μm selected sources in the *Chandra* Deep Field South, where there is extensive multi-wavelength data we are able to exploit. The 70μm catalogue used in this study combines all the publicly available 70μm *Spitzer* data, which we combined and re-reduced using techniques similar to Frayer et al. (2009). This makes our 70μm catalogue currently one of the deepest, which contains sources with fluxes $>$ 2.8 mJy at 5σ. In order to search for X-ray counterparts we combine the 2MS CDFS catalogue (Luo et al. 2008) and the Extended *Chandra* Deep Field South catalogue (Lehmer et al. 2005). We find X-ray counterparts for $\sim 25\%$ of our 70μm sources. We then determine the X-ray luminosity and the total infrared luminosity for each source, and compare this to the star formation relationship of Ranalli et al. (2003). We assume that sources with X-ray luminosity $> 10^{42}$ erg s^{-1} host an AGN, and we find that the AGN fraction increases with an increase in the total infrared luminosity. The total infrared luminosity increases with redshift, we also find that sources with X-ray luminosities $> 10^{42}$ erg s^{-1} are typically at the highest redshifts. We also look at the optical colours of the 70μm sources with X-ray emitting AGN and compare these to the optical colours of the other 70μm sources. *Presented by M Symeonidis*



A Magellan IMACS-IFU Search for Dynamical Drivers of Nuclear Activity

Dr Paul Westoby | Liverpool John Moores University
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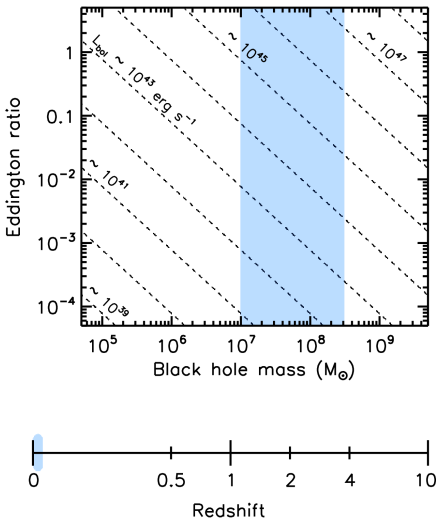
Abstract

We introduce the first statistically-significant investigation of the two-dimensional distribution and kinematics of ionised gas and stars in the central kiloparsec regions of a well-matched sample of Seyfert and inactive control galaxies selected from the Sloan Digital Sky Survey, using the IMACS integral-field unit on the 6.5-m Magellan telescope. The aims of the survey are to search for the dynamical triggers of nuclear activity and to assess the impact of AGN-driven outflows on the host galaxy. Here we present the first results of the survey.



Disentangle AGN and Star Formation at High Redshifts

Dr Renbin Yan | University of Toronto
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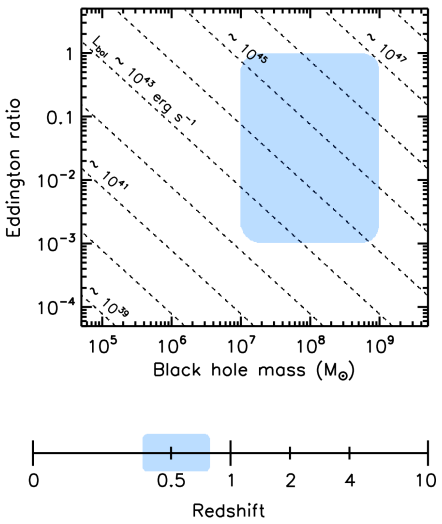
Abstract

To understand the co-evolution of AGN and their host galaxies requires accurate classification between AGN and star-forming galaxies, and disentangling them when they both exist. Both AGN and star formation are more active at higher redshift, but their classification becomes difficult when Hα and [NII] emission lines shift out of the optical window ($z > 0.4$), especially for low-luminosity AGN (LLAGN). We propose a new AGN/SF classification diagram combining [OIII]/H$_\beta$ and optical U-B color, which can be applied at high redshift and effectively recovers the results from the traditional line ratio diagnostics. We combine deep *Chandra* X-ray data with high-quality optical spectra from the DEEP2 survey to classify sources into several classes: AGN, SF, AGN/SF composites, X-ray bright, optically normal galaxies (XBONGs). We investigate the nature of these different classes and evaluate the incompleteness associated with optical and X-ray AGN samples.



Borderline-type 1 QSOs: Probing AGN/host galaxy evolutionary aspects

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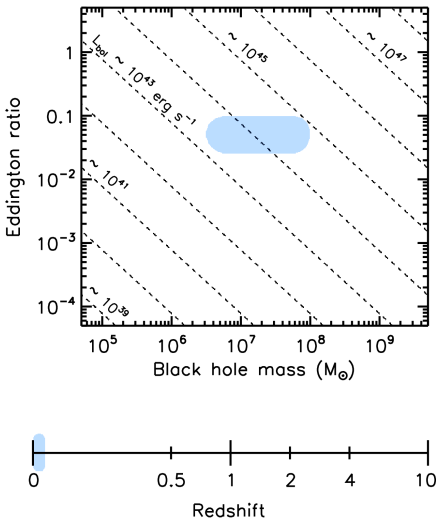
Abstract

I will report on first results of an ongoing multiwavelength campaign of a sample of low redshift ($z < 0.06$) type-1 QSOs. Based on the Hamburg/ESO AGN survey, the QSOs are selected to be close to the classical demarcation in luminosity between Seyferts and QSOs. Our sample is intermediate in terms of mass of cold CO and HI, and bridges the gap between studies of local Seyfert and higher redshift PG-QSOs. I will focus on our recent near-infrared (NIR) imaging and spectroscopy observations with SOFI at the ESO-NTT on La Silla. Less influenced by dust extinction and sensitive to the stellar host, our deep NIR images and spectra will provide important physical properties of the host galaxies of the sample. I will discuss the importance of galaxy mergers for our sample and the first results in the context of the black-hole mass/bulge-velocity-dispersion relation. Furthermore, these objects will be prime targets for upcoming large interferometers like ALMA or the LBT as the first ELT. With the NIR beam-combiner camera LINC/NIRVANA, the borderline QSOs can be studied on linear scales <10 pc (at the sample average redshift of $z = 0.042$), which are similar to current high angular resolution observations of the closest AGN. Only at the sample redshifts the volume density of luminous AGN is high enough to allow for a statistical approach of studying the nuclear and host properties of such AGN, and I will briefly discuss these future prospects.



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