What Drives the Growth of Black Holes?

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

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. The workshop aims to clarify the ranges of parameter space that are probed by different studies, and help understand how the key physical processes may 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?

Detailed information available at http://astro.dur.ac.uk/growthofblackholes/

Venue and Locations

Oral presentations	Kingsley Barrett Lecture Theatre, top floor of the Calman Learning Centre at Durham University
Posters & coffee Sunday evening buffet	Derman Christopherson Room, adjacent to the lecture theatre
Breakfast & lunches	Collingwood College
Workshop photograph & dinner	Durham Castle

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

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Scientific Organising Committee

David Alexander (Durham) ● Ryan Hickox (Durham) ● Philip Best (Edinburgh) ● Ric Davies (Max Planck) ● 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

Workshop 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 (TBC)*

Storchi-Bergmann	Mapping gas inflows towards massive black holes in nearby active galaxies
Davies	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 (TBC)*

Wada (*TBC*)	Molecular Gas Disk Structures Around Active Galactic Nuclei (TBC)
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 (TBC)*

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: TBD*

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**

Workshop Programme

Tuesday 27th July 2010

9.00		**Session 2, block 1** – *Chair: Best (TBC)*
	Bower	Black holes, galaxy formation and the X-ray Universe
	Brandt	Black-hole ecology in the distant Universe
	Schawinski	Black hole growth and its connection to host galaxy evolution
	Goulding	Towards a complete census of AGN activity in nearby galaxies
10.30		**Coffee Break and Poster Session**
11.00		**Session 2, block 2** – *Chair: Dunlop (TBC)*
	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**

Workshop Programme

Wednesday 28th July 2010

9.00		**Session 2, block 3** – *Chair: Hickox (TBC)*
	Silverman	Co-evolving AGN–star formation activity 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 overdense environments
10.30		**Coffee Break and Poster Session**
11.00		**Session 2, block 4** – *Chair: Frenk (TBC)*
	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 (TBC)*
	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 (TBC)*
	Page	Ionized winds in star-forming QSOs
	Hao	SEDs of AGNs from COSMOS: single template with torus-free outliers
	Vignali	Obscured quasars at high redshifts
	Hickox	Clustering of obscured and unobscured quasars
5.30		**End**
7.30		**Prince Bishop Boat Cruise and Dinner (TBC)**

Workshop Programme

Thursday 29th July 2010

9.00	**Session 3, block 3** – *Chair: Siemiginowska (TBC)*	
	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: Lawrence (TBC)*	
	Greene	M–σ relation in the local Universe
	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?
	King	Black hole feedback in action
12.30	**Lunch**	
2.00	**Session 4, block 2** – *Chair: Elvis (TBC)*	
	Gallagher	The role of the high energy continuum in quasar disk winds
	Proga	Detailed simulations of feedback
	Nesvadba	Quantifying the impact of AGN feedback on the evolution of massive galaxies
	Mullaney (*TBC*)	What is driving the feedback-inducing, extended outflows around AGNs?
3.30	**Coffee Break and Poster Session**	
4.00	**Session 4, block 3** – *Chair: Greene (TBC)*	
	McNamara	Feedback from supermassive black holes
	Hardcastle	Radio-loud AGN feedback: how and when does it work?
	Reeves	Ultra fast outflows from AGN and their role in feedback
	Evans	Do AGN outflows cease star formation? Ultradeep *Chandra* HETG observations of NGC 1068
5.30	**End**	

Poster Programme

The posters have been divided into four groups, corresponding roughly to the four main questions addressed at the workshop. Posters are displayed from the start of the workshop through Wednesday morning. 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?
Diamond-Stanic	1.4	*TBC*
Floyd	1.5	*TBC*
Gultekin	1.6	*TBC*
Ishibashi	1.7	Clumpy accretion flows in active galactic nuclei
Jungwiert	1.8	Growth of central supermassive blackholes and bulges due to bars and gas return from old stellar populations
Kuraszkiewicz	1.9	SED and emission line properties of the low redshift red 2MASS AGN
Lagos	1.10	Stellar and AGN accretion disc alignments from SDSS data *Presented by C Lacey*
Lawrence	1.11	Misaligned discs and black hole growth
Westoby	1.12	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	*TBC*
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
Geach	2.8	Lyα Blobs are powered by heating, not cooling
Herbert	2.9	A Sample of Radio Galaxies Spanning Three Decades in Radio Luminosity - The Fundamental Plane and Star Formation Histories
Kimm	2.10	Diffuse gas cooling onto satellite galaxies and its relevance on the black hole growth
Loiseau	2.11	X-ray selected AGNs in the North Ecliptic Pole field
Nugroho	2.12	Integral field spectroscopy of $z \sim 0.1$ QSO host galaxies
Raimundo	2.13	The effects of radiation pressure on the absorption in the *Chandra* Deep Field populations
Siemiginowska	2.14	Cluster–Quasar bound: 3C186, a quasar in a massive cluster at high redshift
Smolcic	2.15	Observational constraints on the importance of radio-mode feedback in massive galaxy formation
Symeonidis	2.16	The AGN content of infrared-selected luminous galaxies
Tugwell	2.17	X-ray properties of Infrared luminous galaxies
Yan	2.18	Disentangle AGN and Star Formation at High Redshifts
Zuther	2.19	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 $z \sim 2$
Bonoli	3.3	Growing black holes: a comparison between semianalytical models and hydro simulations
Carrera	3.4	Exploring structure around submm-bright QSOs *Presented by M Page*
Cisternas	3.5	No merger-quasar connection since $z \sim 1$
Down	3.6	Modelling quasar accretion disks from H-alpha emission
Lietzen	3.7	Large scale environments of nearby quasars
Mainieri	3.8	Black-hole accretion and on-going star formation in obscured quasars
Ross	3.9	The SDSS-III Baryon Oscillation Spectroscopic Survey (BOSS): Quasar Target Selection and First Results from the Commissioning Run
Scharwaechter	3.10	Borderline type-1 QSOs: WiFeS integral field spectroscopy of early-stage QSO candidates
Trakhtenbrot	3.11	Measurements of $M_{\rm BH}$ and $L/L_{\rm Edd}$ in High-Redshift type-I AGN

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
Jahnke	4.5	The M_{BH}–$M_{\rm bulge}$ relation: phenomenology and origin
Kim	4.6	BH mass and Bulge Luminosity Relation in Nearby Type I AGNs
La Franca	4.7	Tools for computing the AGN feedback: radio-loudness distribution and the kinetic luminosity function
Pope	4.8	Controlling cooling flows and optimal AGN feedback

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