

# **Black Hole Feedback 2012**

**Dartmouth–Durham extragalactic workshop**

**Dartmouth College, Hanover, NH (USA)**

**30 July – 3 August 2012**

<http://www.dartmouth.edu/~bhfeedback2012>

Supermassive black holes are among the most powerful objects in the Universe, and their growth as active galactic nuclei (AGN) releases enormous quantities of energy in the form of radiation or mechanical outflows. Through the coupling of this energy to gas, black holes can profoundly influence the evolutionary history of their host galaxies. The past few years have seen remarkable advances in understanding the importance of this black hole - galaxy interaction, but key questions remain about the physics of how this interplay occurs.

This workshop aims to bring together a small number of observers and theorists working at the cutting edge of this discipline, to discuss what we've learned in recent years through observations and theory, and to chart exciting future directions. Questions to be addressed include:

- Is the observed star formation in galaxies influenced by the presence of an AGN?
- How prevalent are galaxy-wide outflows launched by AGN? When are they driven by radiative winds as opposed to relativistic jets?
- Do high-redshift galaxies experience a merger-driven evolutionary sequence that fuels a quasar? Do quasar winds expel gas from halos at high redshift?
- What is the balance of heating vs. cooling in hot halo atmospheres? How do relativistic jets couple to gas?

*Cover image credit: NASA/CXC/Waterloo/C. Kirkpatrick/NSF/NRAO/VLA/CFHT/DSS; NASA/CXC/M. Weiss; Joseph Mehling '69*

## Venue and Locations

Welcome Reception	Top of the Hop at the Hopkins Center for the Arts
Oral Presentations	Class of 1978 Life Sciences Center, Room 200
Dorm Accommodation	Fahey Hall
Breakfast & lunches	Class of 1953 Commons
Workshop dinner	Dartmouth Outing Club House, Occom Pond

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## Presentation Information

*Talks* – All talks are 20 minutes with 5 minutes for questions.

*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).

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## Invited Speakers and Discussion Leaders

Tiziana Di Matteo • Sarah Gallagher • Christine Jones • Andrew King • Matt Lehnert • Raffaella Morganti • Joey Neilsen • Rich Plotkin • Michael Wise

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## Organizing Committee

Ryan Hickox (Dartmouth) • David Alexander (Durham) • Richard Bower (Durham) • Sera Markoff (Amsterdam) • Brian McNamara (Waterloo/Perimeter Institute) • Nicole Nesvadba (IAS Orsay)

Kevin Hainline (Dartmouth) • Francesca Civano (SAO) • Chien-Ting Chen (Dartmouth) • Chris Harrison (Durham)

# Oral Program

Sunday 29 July 2012

**6.00-7.30**            **Welcome Reception at Top of the Hop**

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Monday 30 July 2012

**Session 1:** *Is star formation in galaxies influenced by the presence of an AGN? Do high-z galaxies experience a merger-driven evolutionary sequence that fuels a quasar?*

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

Organizers	>Welcome and overview of the workshop
Bower	Why black hole feedback? and session preview
Bennert	Exploring the origin of the BH mass scaling relations

**10.30**                    **Coffee Break and Poster Session**

**11.15**                    **Session 1, block 2** – *Chair: Bower*

Rosario	The mean star-formation Rate of active galaxies: Results from PEP
Mullaney	Evidence for a universal SMBH accretion to star-formation rate ratio since $z \sim 2$ producing the $M_{\text{BH}}-M_{\text{Bulge}}$ relation
Hickox	AGN variability and the links between star formation and BH growth

**12.30**                    **Lunch**

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

Ballantyne	Connecting star formation, galaxy evolution and the growth of BHs
Aird	Understanding the rapid decline of BH growth and SF since $z \sim 1$
Bongiorno	Host galaxies of AGN in the COSMOS field: black hole growth, star formation and scaling relations

**3.15**                    **Oral Presentation of Posters**

**3.30**                    **Coffee Break and Poster Session**

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

Kocevski	AGN activity at the quenching threshold
Goulding	The evolution of AGN and their host galaxies to $z \sim 1$ in wide-field multi-wavelength surveys
Civano	A galaxy without its own supermassive black hole: implications for feedback

# Oral Program

Tuesday 31 July 2012

**9.15**                    **Session 1, block 5** – *Chair: Akiyama*

Glikman	Dust reddened quasars: a transitional phase in quasar/galaxy co-evolution
Dicken	The star formation histories of powerful radio galaxies
Alexander	Shutdown of star formation in distant AGN-hosting galaxies

**10.30**                    **Coffee Break and Poster Session**

**11.15**                    **Discussion Session 1** – *Leaders: Alexander, Civano, Hickox*

**12.30**                    **Lunch**

**Session 2:** *How prevalent are galaxy-wide outflows launched by AGN? When are they driven by radiative winds as opposed to relativistic jets?*

**2.00**                    **Session 2, block 1** – *Chair: Gallagher*

King	Overview of energetic outflows and session preview
Tombesi	X-ray evidence for accretion disk outflows in local AGNs and their role on feedback
Ebrero	AGN winds as probes of cosmic feedback: the case of Mrk 509
Muller-Sanchez	Measuring AGN Feedback from Seyfert galaxy outflows with AO integral field spectroscopy

**3.40**                    **Coffee Break and Poster Session**

**4.10**                    **Session 2, block 2** – *Chair: Hickox*

Di Matteo	AGN feedback in cosmological simulations
Faucher-Giguere	Physics of galaxy-scale AGN outflows
Lehnert	Galaxy-wide outflows
Morganti	Radio jets and outflows of cold gas

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Wednesday 1 August 2012

**9.00**                    **Session 2, block 3** – *Chair: Mullaney*

Liu	Gemini IFU observations of feedback from radio-quiet quasars at $z \sim 0.5$
Harrison	AGN-driven outflows in high-redshift ULIRGs
Sell	A sample of extreme merger-driven starburst galaxies as viewed by the <i>Chandra</i> and <i>Hubble</i> Space Telescopes
Hainline	AGN outflows and the impact of AGNs on star formation at $z \sim 2-3$

**10.40**                    **Coffee Break and Poster Session**

**11.10**                    **Discussion Session 2** – *Leaders: Gallagher, King, Morganti*

**12.25**                    **Lunch**

**Free Afternoon with outdoor and cultural activities**

# Oral Program

Thursday 2 August 2012

**Session 3:** *What is the balance of heating vs. cooling in hot halo atmospheres? How do relativistic jets couple to gas?*

**9.15**                    **Session 3, block 1 – Chair: Wise**

McNamara	Overview of heating of hot atmospheres and session preview
Blanton	AGN in clusters of galaxies: feedback, sloshing, and lobe bending
C. Jones	AGN activity in ellipticals and groups

**10.30**                    **Coffee Break and Poster Session**

**11.15**                    **Session 3, block 2 – Chair: McNamara**

Markoff	X-ray binaries and insights into AGN accretion physics
Plotkin	From X-ray binaries to AGN: the disk/jet connection
Neilsen	Winds and jets in X-ray binaries

**12.30**                    **Lunch**

**2.00**                    **Session 3, block 3 – Chair: La Franca**

Yuan	Outflow from hot accretion flow: nature, origin and main properties
Nulsen	Heating hot atmospheres by radio jets: weak shocks & sound dissipation
Fujita	Heating of cluster cooling cores by cosmic-ray streaming

**3.15**                    **Coffee Break and Poster Session**

**3.45**                    **Session 3, block 4 – Chair: Blanton**

Chang	The plasma physics and cosmology of TeV blazars
Ma	Contribution of radio-mode AGN heating in clusters
Stott	The XMM Cluster Survey: the interplay between the brightest cluster galaxy and the intra-cluster medium via AGN feedback

**6.30**                    **Workshop Dinner at Dartmouth Outing Club House, Occom Pond**

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Friday 3 August 2012

**9.15**                    **Session 3, block 5 – Chair: Wegner**

Miller	The role of environment in low-level AGN activity
Danielson	The cosmic history of hot gas cooling and radio AGN heating in massive early-type galaxies
Su	The discovery of giant gamma-ray bubbles in the Milky Way

**10.30**                    **Coffee Break and Poster Session**

**11.15**                    **Discussion Session 3 – Leaders: C. Jones, Markoff, Wise**

**12.30**                    **Close of Meeting**

## Poster Program

Posters are displayed throughout the workshop in the coffee area. The numbers given below refer to the board on which each poster is displayed.

Akiyama	1	Census of active black holes at $z=1-2$
Baldi	2	Preliminary results on a study of a sample of low-luminosity radio galaxies at $z\sim 1-3$
Banerji	3	Heavily reddened quasars at $z\sim 2$ : a transitional phase in AGN evolution?
Burtscher	4	Resolving AGN outflows
Chen	5	A correlation between star formation rate and average accretion rate in star-forming galaxies
K. Jones	6	Star formation in the circumnuclear region of 5 local LIRGs
Kashi	7	A cold channel for black hole accretion in cosmological simulations
Newton	8	The interplay between supernova and AGN feedback in simulated disc galaxies
Raimundo	9	Probing the inner regions of MCG-06-30-15: the link between AGN activity and star formation
Rovilos	10	AGN-host correlation detected using the deepest X-ray and far-IR surveys
Sadowski	11	GRMHD simulations of ADAFs: outflows and convection
Tremblay	12	Unique multiphase signatures of AGN feedback in Abell 2597