Andrew Chael | CV

CONTACT

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Black Hole Initiative
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RESEARCH INTERESTS

Astrophysical black holes, accretion, relativistic jets, magnetohydrodynamic simulations, computational imaging.

EDUCATION

Harvard University, Cambridge, MA 2013 – 2019
Ph.D. in Physics, May 2019
A.M. in Physics, March 2015

Carleton College, Northfield, MN 2009 – 2013
B.A. in Physics summa cum laude*, June 2013*
Secondary Concentration in Medieval and Renaissance Studies

RESEARCH EXPERIENCE

Black Hole Initiative Postdoctoral Fellow 2019
Center for Astrophysics | Harvard & Smithsonian

Graduate Researcher 2015 – 2019
Accretion Theory, Center for Astrophysics | Harvard & Smithsonian

- Adviser: Ramesh Narayan
- Work on evolving relativistic thermal and nonthermal particle populations in simulations of black hole accretion.
- Maintain and develop `KORAL`, a massively parallel C code to evolve plasmas in general relativity.

Graduate Researcher 2014 – 2019
VLBI Imaging, Center for Astrophysics | Harvard & Smithsonian

- Advisers: Sheperd Doeleman and Michael Johnson'
- Work on image reconstruction and polarimetry using Event Horizon Telescope observations of Sagittarius A* and M87.
- Wrote and developed `ehtim`, an open-source python software suite for data analysis and imaging in radio interferometry.

Graduate Researcher 2015
Cosmology, Harvard University Department of Physics

- Adviser: Cora Dvorkin
- Worked on constraining light dark matter scattering with baryons.

Visiting Research Assistant 2011 – 2012

Pulsar Astronomy, CSIRO Astronomy and Space Science

- Adviser: Ryan Shannon
- Worked on statistical analysis of pulsar emission polarization and pulsar timing array observations with the Parkes radio telescope.

Research Assistant 2010 – 2013

Pulsar Astronomy, Carleton College

- Adviser: Joel Weisberg
- Worked on refining uncertainties on pulsar distances with accurate statistics and precision timing of binary orbit decay from gravitational wave emission.

Teaching and Mentorship Experience

Resident Tutor 2015 – 2019

Dunster House, Harvard College

- Serve as a live-in mentor and resident advisor for Harvard undergraduates.
- Lead BGLTQ mentoring and advising.

Fellowships Committee Chair 2017 – 2019

Dunster House, Harvard College

- Lead fellowships and graduate school advising for ∼400 undergraduates.
- Conduct advising meetings, review applications, and lead mock interviews.
- Write Harvard College endorsement letters for scholarship applicants.

Teaching Consultant 2016 – 2018

Department of Physics, Harvard University

- Mentored new Physics Teaching Fellows in workshops and review sessions.

Teaching Fellow 2015 – 2016

Department of Physics, Harvard University

- PHYS 125: Widely Applied Physics, Fall 2015. (Prof. John Doyle)
- PHYS 175: Laser and Modern Optical Physics, Spring 2016. (Prof. Markus Greiner)
- Designed and ran interactive weekly sections as the sole teaching fellow for two upper-level undergraduate courses.
- Wrote and graded weekly problem sets, midterms, and final exams.

Peer Tutor 2010 – 2013

Carleton College Department of Physics

- Assisted introductory physics students with group study sessions.
- Led student telescope observations for astronomy class research projects.

Writing Consultant 2010 – 2013

Carleton College Writing Center

- Assisted students with academic writing via one-on-one tutoring.
- Served as designated course writing assistant for three freshman seminars.

First Author Publications

A Chael, R Narayan, M Johnson. "Two-temperature, Magnetically Arrested Disc simulations of the supermassive black hole in M87." *Monthly Notices of the Royal Astronomical Society* 486, p.2873-2895, 2019.
doi:10.1093/mnras/stz988

A Chael, M Rowan, R Narayan, MD Johnson, L Sironi. "The role of electron heating physics in images and variability of the Galactic Center black hole Sagittarius A*." *Monthly Notices of the Royal Astronomical Society* 478, p.5209–5229, 2018.
doi:10.1093/mnras/sty1261

A Chael, MD Johnson, KL Bouman, L Blackburn, K Akiyama, R Narayan. "Interferometric imaging directly with closure phases and closure amplitudes." *The Astrophysical Journal* 857, 23, 2018.
doi:10.3847/1538-4357/aab6a8

A Chael, R Narayan, A Sadowski. "Evolving non-thermal electrons in simulations of black hole accretion." *Monthly Notices of the Royal Astronomical Society* 470, p.2367–2386, 2017.
doi:10.1093/mnras/stx1345

A Chael, MD Johnson, R Narayan, SS Doeleman, J Wardle, KL Bouman. "High-resolution linear polarimetric imaging for the Event Horizon Telescope." *The Astrophysical Journal* 829, 11, 2016.
doi:10.3847/0004-637X/829/1/11

Collaboration Publications

The Event Horizon Telescope Collaboration et al., "First M87 Event Horizon Telescope results I: the shadow of the supermassive black hole." *The Astrophysical Journal Letters* 875, L1, 2019.
doi:10.3847/2041-8213/ab0ec7

The Event Horizon Telescope Collaboration et al., "First M87 Event Horizon Telescope results II: array and instrumentation." *The Astrophysical Journal Letters* 875, L2, 2019.
doi:10.3847/2041-8213/ab0c96

The Event Horizon Telescope Collaboration et al., "First M87 Event Horizon Telescope results III: data processing and calibration." *The Astrophysical Journal Letters* 875, L3, 2019.
doi:10.3847/2041-8213/ab0c57

The Event Horizon Telescope Collaboration et al., "First M87 Event Horizon Telescope results IV: imaging the central supermassive black hole." *The Astrophysical Journal Letters* 875, L4, 2019. **(One of five paper coordinators)**
doi:10.3847/2041-8213/ab0e85

The Event Horizon Telescope Collaboration et al., "First M87 Event Horizon Telescope results V: physical origin of the asymmetric ring." *The Astrophysical Journal Letters* 875, L5, 2019.
doi:10.3847/2041-8213/ab0f43

The Event Horizon Telescope Collaboration et al., "First M87 Event Horizon Telescope results VI: the shadow and mass of the central black hole." *The Astrophysical Journal Letters* 875, L6, 2019.
doi:10.3847/2041-8213/ab1141

Other Publications

S Issaoun et al. "The size, shape and scattering of Sagittarius A* at 86 GHz: first VLBI with ALMA." *The Astrophysical Journal* 871, 30, 2019.
doi:10.3847/1538-4357/aaf732

W Lu, C Dvorkin, **A Chael**. "Probing sub-GeV dark matter-baryon scattering with cosmological observables." *Physical Review D* 97, 103530, 2018.
doi:10.1103/PhysRevD.97.103530

KL Bouman, MD Johnson, A Dalca, **A Chael**, F Roelofs, SS Doeleman, W Freeman. "Reconstructing video from interferometric measurements of time-varying sources." *IEEE Transactions on Computational Imaging,* 2018.
doi:10.1109/TCI.2018.2838452

MD Johnson, KL Bouman, L Blackburn, **A Chael**, J Rosen, H Shiokawa, F Roelofs, K Akiyama, V Fish, SS Doeleman. "Dynamical imaging with interferometry." *The Astrophysical Journal* 850, 172, 2018.
doi:10.3847/1538-4357/aa97dd

A Sadowski, M Wielgus, R Narayan, D Abarca, J McKinney, **A Chael**. "Radiative, two-temperature simulations of low-luminosity black hole accretion flows in general relativity." *Monthly Notices of the Royal Astronomical Society* 466, p. 705–725, 2018.
doi:10.1093/mnras/stw3116

K Akiyama, K Kuramochi, S Ikeda, V Fish, F Tazaki, M Honma, SS Doeleman, A Broderick, J Dexter, M Moscibrodzka, KL Bouman, **A Chael**, A Zaizen. "Imaging the Schwarzschild-radius-scale structure of M87 with the Event Horizon Telescope using sparse modeling." *The Astrophysical Journal* 838, 1, 2017.
doi:10.3847/1538-4357/aa6305

G Ortiz-Leon et al. "The intrinsic shape of Sagittarius A* at 3.5-mm wavelength." *The Astrophysical Journal* 824, 40, 2016.
doi:10.3847/0004-637X/824/1/40

V Fish et al. "Persistent asymmetric structure of Sagittarius A* on event horizon scales." *The Astrophysical Journal* 820, 90, 2016. doi:10.3847/0004-637X/820/2/90

MD Johnson et al. "Resolved magnetic field structure and variability near the event horizon of Sagittarius A*." *Science* 350, p. 1242–1245, 2015. doi:10.1126/science.aac7087

MD Johnson, A Loeb, H Shiokawa, **A Chael**, SS Doeleman. "Measuring the direction and angular velocity of a black hole accretion disk via lagged interferometric covariance." *The Astrophysical Journal* 813, 132, 2015. doi:10.1088/0004-637X/813/2/132

P Verbiest, JM Weisberg, **A Chael**, K Lee, D Lorimer. "On pulsar distance measures and their uncertainties." *The Astrophysical Journal* 775, 39, 2012. doi:10.1088/0004-637X/755/1/39

Selected Talks

"In the shadow of the black hole." *GitHub Satellite 2019*
Invited. Berlin, Germany. May 2019.

"Photographing a black hole with the Event Horizon Telescope." *Carleton College Physics Special Lecture.*
Invited. Northfield, MN. May 2019.

"Simulating and imaging supermassive black hole accretion flows." *Black Hole Initiative Colloquium.*
Invited. Cambridge, MA. May 2019.

"Two-temperature, radiative, MAD simulations of the supermassive black hole in M87." *Center for Astrophysics ITC lunch.*
Invited (Keto Prize Talk). Cambridge, MA. May 2019.

"Photographing black holes: first results from the Event Horizon Telescope." *Harvard University, Special Colloquium.*
Cambridge, MA. April 2019.

"What will the EHT see? Electron heating in simulations of Sgr A* and M87." *Columbia Astronomy Thursday Seminar.*
Invited. New York, NY. November 2018.

"Electron heating and particle acceleration in GRMHD simulations of Sgr A*." *The Central Arcsecond: Towards Testing GR in the Galactic Center.*
Invited. Ringberg, Germany. November 2018.

"What will the EHT see? Electron heating in simulations of Sgr A* and M87." *Northwestern CIERA Theory Group Meeting.*
Invited. Evanston, IL. October 2018.

"Electron heating physics in images and variability of Sgr A*." *15th Marcel Grossman Meeting on General Relativity.*
Invited. Rome, Italy. July 2018.

"The role of electron heating physics in images and variability of Sgr A*." *28th New England Regional Quasar and AGN Meeting.*
New Haven, CT. May 2018.

"Imaging a black hole with the Event Horizon Telescope." *907th Amateur Telescope Makers of Boston Monthly Meeting.*
Invited. Cambridge, MA. March 2018.

"Evolving thermal and nonthermal electron distributions in simulations of Sagittarius A*." *231st Meeting of the American Astronomical Society.*
Washington, DC. January 2018.

"Evolving thermal and nonthermal electron distributions in accretion simulations." *13th School of Modern Astrophysics.*
Moscow, Russia. July 2017.

"Evolving thermal and nonthermal electron distributions in accretion simulations." *When Brandeis Met Jansky: Astrophysics and Beyond.*
Waltham, MA. May 2017.

"Imaging techniques for the Event Horizon Telescope." *3rd Event Horizon Telescope Collaboration Meeting.*
Invited. Cambridge, MA.

"Evolving non-thermal electron distributions in accretion simulations." *3rd Event Horizon Telescope Collaboration Meeting.*
Cambridge, MA. December 2016.

"Imaging black hole magnetic fields with the Event Horizon Telescope." *M87 Workshop: Towards the 100th Anniversary of the Discovery of Cosmic Jets.*
Taipei, Taiwan. May 2016.

"Probing Dynamical Activity near the Event Horizon with the EHT." *2nd Event Horizon Telescope Collaboration Meeting.*
Invited. Waterloo, ON. November 2014.

Academic Service

Organizer, 1st EHT Imaging Workshop, Cambridge, MA. November 2017.

Organizer, 2nd EHT Imaging Workshop, Cambridge, MA. July 2018.

Reviewer, Monthly Notices of the Royal Astronomical Society. 2019

Reviewer, Advances in Space Research. 2019

Honors	Eric Keto Prize in Theoretical Astrophysics, Harvard Astronomy	2019
	Harvard University Certificate of Distinction in Teaching	2016
	NSF Graduate Research Fellowship Honorable Mention	2014
	Phi Beta Kappa, Carleton College	2013
	Distinction in Physics and Integrative Exercise, Carleton College	2013
	Lawrence McKinley Gould Prize in Natural Science, Carleton College	2013
	Catherine Boyd Prize in Medieval Studies, Carleton College	2013
	Rhodes Scholarship Finalist	2013
	Kolenkow-Reitz Research Fellowship, Carleton College	2012
	Patricia Damon Merit Scholarship, Carleton College	2012
	Phillip Niles Prize in Medieval Studies, Carleton College	2011
	Dean's List, Carleton College	2010, 2011, 2012
	United States Department of Education Presidential Scholar	2009
Programming Skills	C, Python, Fortran, *Mathematica*, HTML/CSS	
Languages	French (Proficient), Mandarin Chinese (Intermediate)	