Andrew Chael

CONTACT

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RESEARCH INTERESTS

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

EDUCATION

Harvard University, Cambridge, MA, USA 2013 –
Ph.D. Candidate in Physics, expected 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

SELECTED RESEARCH EXPERIENCE

Graduate Researcher 2015 –
Accretion Theory, Harvard-Smithsonian Center for Astrophysics

- Adviser: Ramesh Narayan
- Work on evolving relativistic 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 –
Computational VLBI Imaging, Harvard-Smithsonian Center for Astrophysics

- 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`, a 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 the properties of light dark matter scattering with baryons through imprints on CMB temperature and polarization maps.

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.

Selected Teaching and Mentorship Experience

Resident Tutor 2015 –

Dunster House, Harvard College

- Serve as a live-in mentor and resident advisor for Harvard undergraduates.
- Lead curriculum advising and tutoring in Physics/Astronomy.
- Lead BGLTQ mentoring and advising.

Fellowships Committee Chair 2017 –

Dunster House, Harvard College

- Lead fellowships and graduate school application advising for >350 Harvard undergraduates.
- Conduct advising meetings, review application statements, and conduct mock interviews.
- Write Harvard College institutional endorsement letters for national 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 Physics 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.

Writing Consultant 2010 – 2013

Carleton College Department of Physics

- Assisted introductory physics and astronomy 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*, submitted. arXiv: 1810.01983

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

Other Publications

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, K Akiyama, KL Bouman, **A Chael**, MD Johnson, SS Doeleman, L Blackburn, J Wardle, W Freeman, "Observing – and Imaging – Active Galactic Nuclei with the Event Horizon Telescope." *Galaxies* 4, p. 54, 2016. doi:10.3390/galaxies4040054

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

"Electron heating and particle acceleration in GRMHD simulations." *The Central Arcsecond: Towards Testing General Relativity in the Galactic Center.* Invited. Munich, Germany. November 2018.

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

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

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

"Evolving thermal and nonthermal electron distributions in simulations of Sagittarius A*." *231^{st}*

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.

Honors

Harvard University Certificate of Distinction in Teaching	2016
National Science Foundation Graduate Research Fellowship Honorable Mention	2014
Phi Beta Kappa, Carleton College	2013
Distinction in Physics and Distinction in Integrative Exercise, Carleton College	2013
Lawrence McKinley Gould Prize in Natural Science, Carleton College	2013
Catherine Boyd Prize in Medieval and Renaissance 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 and Renaissance 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, Mandarin Chinese (Intermediate)