

Katherine (Katie) L. Bouman

CONTACT INFORMATION	391 S. Holliston, Mail Code 305-16 Pasadena, CA 91125 USA	<i>E-mail:</i> klbouman@caltech.edu <i>Website:</i> http://users.cms.caltech.edu/~klbouman
POSITION	Assistant Professor and Rosenberg Scholar, California Institute of Technology <i>Departments of Computing and Mathematical Sciences, Electrical Engineering, and Astronomy</i>	
RESEARCH INTERESTS	Computational imaging, computational photography, computer vision, image and video processing, inverse problems, and machine learning	
EDUCATION	Harvard-Smithsonian Center for Astrophysics , Cambridge, MA, USA <i>Postdoctoral Fellow</i>	2017 - 2019
	Massachusetts Institute of Technology , Cambridge, MA, USA <i>Ph.D. Student in Electrical Engineering and Computer Science</i> <i>Minor in Brain and Cognitive Sciences</i> <ul style="list-style-type: none">• Thesis: “Extreme Imaging via Physical Model Inversion: Seeing Around Corners and Imaging Black Holes”• Advisor: William Freeman	2011 - 2017
	Massachusetts Institute of Technology , Cambridge, MA, USA <i>M.S. in Electrical Engineering and Computer Science</i> <ul style="list-style-type: none">• Thesis: “Estimating the Material Properties of Fabric Through the Observation of Motion”• Advisor: William Freeman	2011 - 2013
	University of Michigan , Ann Arbor, MI, USA <i>B.S.E in Electrical Engineering Summa Cum Laude</i> <i>Minor in Mathematics</i>	2007 - 2011
SELECTED HONORS AND AWARDS	NSF CAREER Award Faculty Teaching Award - one of two awards given by the Graduate Student Council for teaching at Caltech during the 2019-2020 calendar year Breakthrough Prize in Fundamental Physics - Co-recipient with The Event Horizon Telescope Collaboration Scientist of the Year Award - awarded by the Society for Imaging Science and Technology Okawa Research Grant Event Horizon Telescope Early Career Award - for her contributions in developing the imaging algorithms and analysis tools that enabled creating the first image of a black hole, and her leadership in developing a blind comparison framework, leading to the results published in the first six papers	

of the EHT

Ernst A. Guillemin Thesis Prize - for the best masters thesis in EE at MIT (2nd place)

BBC 100 Women Award

NSF Graduate Fellowship

NSF Diamond Achievement Award - Co-recipient with The Event Horizon Telescope Collaboration

Einstein Medal - Co-recipient with The Event Horizon Telescope Collaboration

American Ingenuity Award in Physical Sciences - Co-recipient with The Event Horizon Telescope Collaboration

Irwin and Joan Jacobs Presidential Fellowship

Best Poster Awards (ICCP 2017, IPMI 2017)

Outstanding Reviewer Awards (CVPR 2017, ECCV 2016)

Barry M. Goldwater Scholarship

William Harvey Seeley Prize

CONFERENCE
PUBLICATIONS

*** denotes equal contribution**

H. Sun, **K.L. Bouman**. “Deep Probabilistic Imaging: Uncertainty Quantification and Multi-modal Solution Characterization for Computational Imaging”. *AAAI Conference on Artificial Intelligence*, 2021.

H. Sun, A.V. Dalca, **K.L. Bouman**. “Learning a Probabilistic Strategy for Computational Imaging Sensor Selection”. *International Conference on Computational Photography (ICCP)*, 2020.

KL Bouman, V Ye, AB Yedidia, F Durand, GW Wornell, A Torralba, WT Freeman. “Turning Corners into Cameras: Principles and Method”. *International Conference on Computer Vision (ICCV)*, 2017. (Selected for Spotlight Presentation. This work won the “Best Poster” award at ICCP 2017.)

AV Dalca, **KL Bouman**, WT Freeman, MR Sabuncu, NS Rost, P Golland. “Population Based Image Imputation”. *International Conference on Information Processing and Medical Imaging (IPMI)*, 2017. (Won “Best Poster” Award)

T Xue*, J Wu*, **KL Bouman**, WT Freeman. “Visual Dynamics: Probabilistic Future Frame Synthesis via Cross Convolutional Networks”. *The Conference and Workshop on Neural Information Processing Systems (NIPS)*, 2016. (Selected for Oral Presentation).

KL Bouman, MD Johnson, D Zoran, VL Fish, SS Doleman, WT Freeman. “Computational Imaging for VLBI Image Reconstruction”. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2016. (Selected for Oral Presentation).

A Davis*, **KL Bouman***, JG Chen, M Rubinstein, F Durand, WT Freeman. “Visual Vibrometry: Estimating Material Properties from Small Motions in Video”. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2015. (Selected for Oral Presentation).

KL Bouman, B Xiao, P Battaglia and W Freeman. “Estimating the Material Properties of Fabric Through Observation of Motion”. *IEEE International Conference on Computer Vision (ICCV)*, 2013.

K Ni, E Phelps, **KL Bouman**, and N Bliss. “Training image classifiers with similarity metrics, linear programming, and minimal supervision”. *Asilomar Conference on Signals, Systems, and Computers. (Asilomar)*, 2012.

KL Bouman, V Ramachandra, K Atanassov, M Aleksic, and SR Goma. “RAW camera DPCM compression performance analysis”. *Proceedings of SPIE-IS&T Electronic Imaging*, 2011.

KL Bouman, G Abdollahian, M Boutin, and EJ Delp. “A low complexity method for detection of text area in natural images”. *International Conference on Acoustics Speech and Signal Processing (ICASSP)*, 2010.

JOURNAL
PUBLICATIONS

JY Kim, TP Krichbaum, AE Broderick, M Wielgus, L Blackburn, JL Gomez, MD Johnson, **KL Bouman**, A Chael, K Akiyama, S Jorstad, AP Marscher, S Issaoun, M Janssen, CK Chan, T Savolainen, D Pesce, F Ozel, and the Event Horizon Telescope Collaboration “Event Horizon Telescope imaging of the archetypal blazar 3C 279 at an extreme 20 microarcsecond resolution” *Astronomy & Astrophysics*, 2020.

F Roelofs, M Janssen, I Natarajan, R Deane, J Davelaar, H Olivares, O Porth, SN Paine, **KL Bouman**, RPJ Tilanus, IM van Bemmelen, H Falcke, K Akiyama and the Event Horizon Telescope Collaboration “SYMBA: An end-to-end VLBI synthetic data generation pipeline” *Astronomy & Astrophysics*, 2020.

L Blackburn, C Chan, GB Crew, VL Fish, S Issaoun, MD Johnson, M Wielgus, K Akiyama, J Barrett, **KL Bouman**, R Cappallo, AA Chael, M Janssen, CJ Lonsdale, SS Doeleman “EHT-HOPS pipeline for millimeter VLBI data reduction” *The Astrophysics Journal*, 2019.

DCM Palumbo, SS Doeleman, MD Johnson, **KL Bouman**, AA Chael. “Metrics and Motivations for Earth-Space VLBI: Time-Resolving Sgr A* with the Event Horizon Telescope” *The Astrophysics Journal*, 2019.

The Event Horizon Telescope Collaboration, et al. “First M87 Event Horizon Telescope Results. IV. Imaging the Central Supermassive Black Hole.” *The Astrophysics Journal Letters*, 2019. (**KL Bouman** was a Paper Coordinator)

The Event Horizon Telescope Collaboration, et al. “First M87 Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole.” *The Astrophysics Journal Letters*, 2019.

The Event Horizon Telescope Collaboration, et al. “First M87 Event Horizon Telescope Results. II. Array and Instrumentation.” *The Astrophysics Journal Letters*, 2019.

The Event Horizon Telescope Collaboration, et al. “First M87 Event Horizon Telescope Results. III. Data Processing and Calibration.” *The Astrophysics Journal Letters*, 2019.

The Event Horizon Telescope Collaboration, et al. “First M87 Event Horizon Telescope Results. V. Physical Origin of the Asymmetric Ring.” *The Astrophysics Journal Letters*, 2019.

The Event Horizon Telescope Collaboration, et al. “First M87 Event Horizon Telescope Results. VI. The Shadow and Mass of the Central Black Hole.” *The Astrophysics Journal Letters*, 2019.

S. Issaoun, MD. Johnson, L Blackburn, CD Brinkerink, M Moscibrodzka, A Chael, C Goddi, I Marti-Vidal, J Wagner, SS Doeleman, H Falcke, TP Krichbaum, K Akiyama, U Bach, **KL Bouman**, GC Bower, A Broderick, I Cho, G Crew, J Dexter, V Fish, R Gold, JL Gomez, K Hada, A Hernandez-Gomez, M Janssen, M Kino, M Kramer, L Loinard, R-S Lu, S Markoff, DP Marrone, LD Matthews, JM Moran, C Muller, F Roelofs, E Ros, H Rottmann, S Sanchez, RP. J Tilanus, P de Vicente, M

Wielgus, JA Zensus, G-Y Zhao. “The Size, Shape, and Scattering of Sagittarius A* at 86 GHz: First VLBI with ALMA”. *The Astrophysics Journal*, 2019.

AV Dalca, **KL Bouman**, WT Freeman, MR Sabuncu, NS Rost, P Golland. “Medical Image Imputation from Image Collections published in IEEE Transactions on Medical Imaging”. *IEEE Transactions on Medical Imaging*, 2018.

T Xue*, J Wu*, **KL Bouman**, WT Freeman. “Visual Dynamics: Stochastic Future Generation via Layered Cross Convolutional Networks”. (*TPAMI*), 2018.

KL Bouman, MD Johnson, AV Dalca, A Chael, F Roelofs, SS Doeleman, WT Freeman. “Reconstructing Video of Time-Varying Sources from Radio Interferometric Measurements”. *IEEE Transactions on Computational Imaging*, 2018.

A Chael, , MD Johnson, **KL Bouman**, L Blackburn, K Akiyama, R Narayan. “Interferometric Imaging Directly with Closure Phases and Closure Amplitudes”. *The Astrophysics Journal*, 2018.

MD Johnson, **KL Bouman**, L Blackburn, A Chael, J Rosen, H Shiokawa, F Roelofs, K Akiyama, VL Fish, SS Doeleman. “Dynamical Imaging with Interferometry”. *The Astrophysics Journal*, 2017.

K Akiyama, K Kuramochi, S Ikeda, VL Fish, F Tazaki, M Honma, SS Doeleman, A Broderick, J Dexter, M Moscibrodzka, **KL Bouman**, A Chael, M Zaizen. ”Imaging the Schwarzschild-radius-scale Structure of M87 with the Event Horizon Telescope using Sparse Modeling”. *The Astrophysical Journal*, 2017.

A Davis*, **KL Bouman***, JG Chen, M Rubinstein, O Buyukozturk, Durand, WT Freeman. “Visual Vibrometry: Estimating Material Properties from Small Motions in Video”. *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, 2017.

VL Fish, K Akiyama, **KL Bouman**, A Chael, MD Johnson, SS Doeleman, L Blackburn, JFC Wardle, WT Freeman, “Observing and Imaging Active Galactic Nuclei with the Event Horizon Telescope”. *Galaxies*, 2016.

A Chael, MD Johnson, R Narayan, SS Doeleman, JFC Wardle, **KL Bouman** “High Resolution Linear Polarimetric Imaging for the Event Horizon Telescope”. *The Astrophysical Journal*, 2016.

VL Fish, MD Johnson, R Lu, S. Doeleman, **KL Bouman**, D Zoran, WT Freeman, D Psaltis, R Narayan, V Pankratius, A Broderick, C Gwinn, L Vertatschitsch. “Imaging an Event Horizon: Mitigation of Scattering toward Sagittarius A*”. *The Astrophysical Journal*, 2014.

KL Bouman, G Abdollahian, M Boutin, and EJ Delp. “A low complexity sign detection and text localization method for mobile applications”. *IEEE Transactions on Multimedia*, 2011.

SELECTED RESEARCH GRANTS AND CONTRACTS Principal Investigator of CAREER Award: “CAREER: Co-Optimized Sensing and Reconstruction for Next-Generation Computational Cameras” through the National Science Foundation (NSF). Award number 2048237 (Awarded January 2021)

Rose Hills Innovator Grant. (Awarded January 2021)

Okawa Research Grant.(Awarded June 2020)

Sub-award Principal Investigator of Mid-scale RI-1 (M1:DP): “Next Generation Event Horizon Telescope Design” through the National Science Foundation (NSF). Award number 1935980 (Awarded

October 2019)

Principal Investigator: “Beyond Interstellar: Extracting Science from Black Hole Images,” Keck Institute for Space Studies (KISS) (Awarded February 2019)

PATENTS

K Ni, **KL Bouman**, and N Bliss. “Sparse Class Representation with Linear Programming”. MIT12-01(15271L). 2012.

INVITED TALKS &
PANELS

Talk at Distinctive Voices - National Academy of Sciences (moved online due to COVID-19). January 2021.

Seminar talk at PARC (moved online due to COVID-19). January 2021.

Seminar talk at Harvard Medical School (moved online due to COVID-19). January 2021.

Seminar talk at Harvard Medical School (moved online due to COVID-19). January 2021.

Colloquium in the College of Optical Sciences at the University of Arizona (moved online due to COVID-19). January 2021.

Seminar talk at University of Edinburgh (moved online due to COVID-19). December 2020.

Seminar talk at Federal University of Rio de Janeiro (moved online due to COVID-19). December 2020.

Invited Talk at Learning Meets Combinatorial Algorithms Workshop at NeurIPS (moved online due to COVID-19). December 2020.

Caltech Astro Public Lecture and Stargazing Series Speaker (moved online due to COVID-19). November 2020

Plenary Speaker at Asilomar (moved online due to COVID-19). November 2020

Physics Colloquium at The Center for Research and Advanced Studies in Mexico City (moved online due to COVID-19). October 2020.

Plenary at the IEEE International Conference on Image Processing (ICIP) Abu Dhabi, United Arab Emirates(moved online due to COVID-19). October 2020.

Innogural Keynote for the Robotics, Vision, and Graphics Program at Universidad de Zaragoza (moved online due to COVID-19). October 2020.

Art+Science (Elementry School Girls at the MIT Museum) (moved online due to COVID-19). October 2020.

Keynote at the Real-World Computer Vision from Inputs with Limited Quality Workshop (moved online due to COVID-19). August 2020.

Invited talk at ICML Workshop on ML Interpretability for Scientific Discovery Vienna, Austria (moved online due to COVID-19). July 2020.

Plenary at the OSA Imaging and Applied Optics Congress Vancouver, Canada (moved online due to COVID-19). June 2020.

University of Waterloo Waterloo, Canada (moved online due to COVID-19). June 2020.

Commencement Speaker at Grinnell College Grinnell, IA (canceled due to COVID-19). May 2020.

Caltech Seminar Day Pasadena, CA. May 2020. (moved online due to COVID-19)

Fireside chat speaker at MARS 2020 Ojai Valley Inn, CA (canceled due to COVID-19). March 2020.

Aronson Lecture - Purdue University West Lafayette, IN. March 2020.

STROBE Seminar - UCLA Los Angeles, CA. February 2020.

Keynote at the Google Computational Imaging Workshop Mountain View, CA. February 2020.

Astronomy Department Colloquium - University of Virginia Charlottesville, VA. January, 2020.

Keynote at Electronic Imaging (EI) Conference San Francisco, CA. January 2020.

Astronomy Department Colloquium - University of Michigan Ann Arbor, MI. January, 2020.

NeurIPS Machine Learning and the Physical Sciences Vancouver, Canada. December 2019

Owens Valley Radio Observatory Seminar Series Big Pine, CA. November 2019.

SC19: The International Conference for High Performance Computing, Networking, Storage, and Analysis Denver, CO. November 2019.

Seeing the Unseen. *EPFL Open Science Day* Lausanne, Switzerland. October 2019.

Seeing the Unseen. *Keynote at Spark + AI Conference* Amsterdam, The Netherlands. October 2019.

Imaging the Unseen: Taking the First Picture of a Black Hole. *Computational Imaging Workshop at the Institute for Mathematics and its Applications (IMA) - University of Minnesota* Minneapolis, Minnesota. October 2019.

Seeing the Unseen. *Keynote at .NEXT Conference* Copenhagen, Denmark. October 2019.

Seeing the Unseen *Keynote at the Cisco Data Symposium* San Jose, CA. September 2019.

Imaging the Unseen: Taking the First Picture of a Black Hole. *Sam Wilson Lecture Series - The University of Oklahoma* Norman, OK. September 2019.

Imaging the Invisible *Jet Propulsion Laboratory (JPL)* La Canada Flintridge, CA. September 2019.

Ideas from Time-Variable Imaging with StarWarps *Event Horizon Telescope Dynamics Meeting* Waterloo, Canada. August 2019.

Imaging a Black Hole with the Event Horizon Telescope. *ACM SIGGRAPH Frontiers* Los Angeles, CA. July 2019.

Imaging a Black Hole with the Event Horizon Telescope. *NASA Ames Summer Series, NASA Ames Research Center* Moffett Field, CA. July 2019.

My Journey Imaging the Invisible *Summer Undergraduate Research Fellowship (SURF) Seminar Series, Caltech* Pasadena, CA. June 2019.

Imaging the Unseen: Taking the First Picture of a Black Hole *Women in Computer Vision, CVPR* Long Beach, CA. June 2019.

Testimony at the House Committee on Science, Space, and Technology. *U.S. House of Representatives* Washington, DC. May 2019.

Imaging a Black Hole with the Event Horizon Telescope. *Board of Trustees of Associated Universities, Inc (AUI)* Boston, MA. May 2019.

Imaging a Black Hole with the Event Horizon Telescope. *NERQEM* Cambridge, MA. May 2019.

Seeing the Unseen *MIT CSAIL Faculty Gala, MIT* Cambridge, MA. May 2019.

Imaging a Black Hole with the Event Horizon Telescope. *EE Seminar Series, University of California - Berkeley* Berkeley, CA. April 2019.

Imaging a Black Hole with the Event Horizon Telescope. *Stanford University* Palo Alto, CA. April 2019.

Imaging a Black Hole with the Event Horizon Telescope. *SCIEN Seminar Series, Harvard University* Cambridge, MA. April 2019.

Recovering Movies of Black Holes (by Expanding the Event Horizon Telescope to Space). *Computational Imaging workshop at ICERM, Brown University* Providence, RI. March 2019.

Data Science Everywhere. *Harvard University* Cambridge, MA. March, 2019.

Artificial Intelligence and Machine Learning. *Caltech Board of Trustees Annual Meeting* Newport Coast, CA. October, 2018.

Turning Corners into Cameras. *Allerton Conference on Communication, Control, and Computing* Allerton, IL. October, 2018.

The Event Horizon Telescope. *SMA Advisory Committee Meeting* Cambridge, MA. July 2018.

Imaging the Invisible. *The Optical Society's Meeting on Computational Optical Sensing and Imaging (COSI)* Orlando, FL. June, 2018.

Corner Cameras. *International Conference on Computational Photography (ICCP)*. Pittsburgh, OH. May, 2018.

Imaging the Invisible. *Interferometry Workshop*. Lexington, MA. April, 2018.

How to Take a Picture of a Black Hole. *New England Computer Vision Workshop (NECV)*. Boston, MA. November, 2017.

Reconstructing a Movie of SgrA* with the EHT. *Astrostatistics Day*. Cambridge, MA. September, 2017.

Photographing a Black Hole. *Boston Museum of Science*. Boston, MA. May, 2017.

The EHT Imaging Challenges. *Event Horizon Telescope Meeting*. Cambridge, MA. November, 2016.

How to Take a Picture of a Black Hole. *TEDx Beacon Street*. Boston, MA. November, 2016.

High Resolution Astronomical Radio Image Reconstruction. *ICCV's Extreme Imaging Workshop*. Santiago, Chile. December 17, 2015.

Visual Vibrometry: Estimating Material Properties from Small Motions in Video". *Rising Stars in EECS: An Academic Workshop for Women*. Boston, MA. November 9, 2015.

A Bayesian Algorithm and Dataset for mm-VLBI Image Reconstruction. *mm-VLBI Data Processing Workshop*. Liden, Netherlands. June 9, 2015.

Object Recognition and Detection in Natural Images. *IEEE Imaging Technology Processing and Applications Course*. MIT Lincoln Laboratory. Lexington, MA. November 26, 2012

TEACHING

Ph.D. Thesis Supervision

Berthy Feng - Ph.D. in CMS from Caltech 2019 - Present

Angela Gao - Ph.D. in CMS from Caltech 2019 - Present

Zihui (Ray) Wu - Ph.D. in CMS from Caltech 2020 - Present

Master Thesis Supervision

Vickie Ye - MEng in EECS from MIT 2017 - 2018

Victoria Gunning - MEng in EECS from MIT 2015 - 2016

Postdoc Supervision

He Sun 2019 - Present

Aviad Levis 2020 - Present

Instructor

CS101C: Computational Cameras, Caltech Spring 2020

awarded faculty teaching award by the Graduate Student Council

CS101C: Machine Learning Projects, Caltech Fall 2020

Teaching Assistant

6.098/6.882: Computational Photography, MIT Spring 2015

ACADEMIC SERVICE

Technical Committee for IEEE Computational Imaging, 2018-Present

Advisory Committee Caltech Resnick Center for Remote Sensing, 2020-Present

Advisory Committee Caltech Center for Autonomous Systems and Technology, 2019-Present

Advisory Committee JPL's Scientific Understanding for Data Science (SUDS) Council, 2020-Present

Committee Computing and Mathematical Sciences Department Committee on Diversity, Inclusion, and Equity 2020-Present

Organizer, Grundfest Memorial Lecture Series

Organizer, Blending Physics and Learning for Computational Imaging at Asilomar 2021

Organizer, CVPR's Computational Cameras and Displays, 2020. Seattle, WA

Organizer, KISS Study on "Beyond Interstellar: Extracting Science from Black Hole Images,"

2019. Pasadena, CA

Organizer, CVPR's Computational Cameras and Displays, 2019. Long Beach, CA

Organizer, Event Horizon Telescope Imaging Workshop, August, 2018. Cambridge, MA.

Organizer, Event Horizon Telescope Imaging Workshop, November, 2017. Cambridge, MA.

Organizer, ICCV's Extreme Imaging Workshop, 2015. Santiago, Chile

Organizer, Computer Vision Meetings at MIT, 2015-2017

Event Horizon Telescope Director Search & Selection Committee, 2019-2020

Event Horizon Telescope Imagng Working Group Coordinator, 2019-Present

Scientific Organizing Committee, The Event Horizon Telescope Imaging Workshop, 2020

Scientific Organizing Committee, Space VLBI Meeting, 2020

Scientific Organizing Committee, The Event Horizon Telescope Collaboration Meeting, 2019

Scientific Organizing Committee, Polarization Workshop for the Event Horizon Telescope, 2019

Finance Chair, for International Conference on Computational Photography (ICCP), May, 2020. St. Louis, MO.

Area Chair, International Conference on Computer Vision (ICCV), 2021

Area Chair, Computer Vision and Pattern Recognition (CVPR), 2021

Area Chair, The British Machine Vision (BMVC), 2020

Area Chair, International Conference on Image Processing (ICIP), 2019, 2020, 2021

Area Chair, International Conference on Acoustics Speech and Signal Processing (ICASSP), 2020, 2021

Program Chair, OSA Computational Optical Sensing and Imaging (COSI), 2019, 2020, 2021

Program Chair, OSA Mathematics in Imaging, 2019

Poster/Demo Chair, for International Conference on Computational Photography (ICCP), May, 2017. Stanford, CA.

Reviewer, Nature Astronomy, Nature Communications, IEEE Transactions on Computational Imaging, CVPR, ECCV, ICCV, ICCP, Advances in Space Research, IEEE Transactions on Visualization and Computer Graphics (TVCG), Transactions on Applied Perception, Optics Express, SPIE Optical Engineering, SIGGRAPH, Eurographics