Dr. Casey J. Law

Contact Information

Staff Scientist
Cahill Center for Astronomy and Astrophysics,
Owens Valley Radio Observatory,
California Institute of Technology
Pasadena, CA 91125

+1-510-859-3636
claw@astro.caltech.edu

Research Interests

Astrophysical transients, fast radio bursts, radio interferometry, surveys, algorithms and computing, data science, Python

Education

Northwestern University, Evanston, IL

Ph.D., Astrophysics, 2007

- Thesis Title: *Surveys of the Galactic Center and the Nature of the Galactic Center Lobe*
- Research Topics: Galactic outflows, radio, X-ray, and infrared observations of the Galactic center
- Adviser: Farhad Yusef-Zadeh

Boston University, Boston, MA

M.A., Astronomy, 2000

- Research Topics: Galactic molecular gas survey, optical photometry of stellar clusters, gravitational lensing
- Advisers: James Jackson, Ken Janes, Tereasa Brainerd

University of Hawai'i, Manoa, Honolulu, HI

B.S. with distinction, Physics, 1998

- Hawai'i Space Grant Fellowship with James Heasley of the Institute for Astronomy
- Research Topic: Optical photometry of globular clusters with the UH 2.2m and CFHT

Employment

Research Scientist July 2019 to present

Cahill Center for Astronomy and Astrophysics & Owens Valley Radio Observatory, Caltech

- Supervisor: Gregg Hallinan
- Leader of Calibration, Imaging, and Software Lab
- Radio transients
- Commissioning of the Owens Valley Long-Wavelength Array and Deep Synoptic Array 110

Assistant Project Astronomer December 2011 to June 2019

Postdoctoral Fellow January 2009 to November 2011

Radio Astronomy Lab, UC Berkeley

- Supervisor: Geoff Bower and Carl Heiles
- Leader of *realfast* fast transient search project at the Very Large Array

- Radio transients and polarimetry
- Commissioning of the Allen Telescope Array, Karoo Array Telescope, Jansky Very Large Array

Postdoctoral Fellow July 2006 to December 2008

Department of Astronomy, University of Amsterdam

- Supervisor: Ralph Wijers
- Low frequency radio transients
- Commissioning of the Low Frequency Array (LOFAR)

Astrophysicist September 2000 to June 2002

Harvard-Smithsonian Center for Astrophysics

- Data analyst and support astronomer for the *Chandra* X-ray Observatory
- Tested, documented, and developed code for the CIAO software package
- 10% of time dedicated to independent research

Teaching and Outreach

Caltech, Pasadena, CA

Student Advising **2019 – 2021**

- Graduate student mentorship (thesis committee): **Kshitij Aggarwal** (West Virginia University)
- Caltech programs: Summer Undergraduate Research Fellowship, Freshman Summer Research Institute, and the Summer Research Consortium
- Mentored undergraduates **Carlos Ayala**, **Tyrone McNichols**, **Jerome (Johnny) Seebeck**

UC Berkeley, Berkeley, CA

Lecturer, Astronomy 290 **2016 – 2018**

- Two guest lectures in graduate course on department research

Visitor, Franklin Elementary, Oakland, California **2016 – 2017**

- Two visits to present astronomy concepts to 3rd graders

Visitor, Mount Diablo Astronomical Society **2017**

- Guest lecture on radio transients

Visitor, Splunk Inc. **2017**

- Guest lecture on radio transients at Splunk Science Society lecture series

Tutor, Cal Bridge **2017**

- Co-organized workshop for Python in Astronomy for CSU-UC bridge program

Volunteer, Berkeley Inst. for Data Science, Open Oakland **2015 – 2018**

- Participated in projects related to air quality, open software, and civic hacking

Tutor and Coordinator, Prison University Project **2010 – 2014**

- Led tutoring of introductory math for college-level curriculum in San Quentin State Prison.

Co-organizer, Science@Cal **2009 – 2014**

- Helped organize and advertise monthly lecture series.
- Demonstrated principles of radio astronomy at annual "Cal Day" event.

Student Advising **2009 – 2019**

- UC LEADS Undergraduate **Luis Chinchilla-Garcia** visited UC Berkeley from UCLA to study clustering algorithms for fast radio transient classification. Summer 2016.
- Doctoral students **Peter Williams**, **Chat Hull**, and **James McBride** Mr. Williams, Mr. Hull, and Mr. McBride used data from the Allen Telescope Array to study radio transients and the polarimetric properties of galaxies. Co-adviser: Carl Heiles and Geoff Bower, 2008 – 2012.
- Undergraduates **Sabrina Berger** (Summer Undergraduate Research Fellow), **Sanyum Channa**, **Andrew Halle**, **Jun Tan**, **Yawen Sun**, **Kyle Blanchard**, and **Phillip Sells**
  Students have worked with realfast data analysis, FRB science, the NERSC supercomputer, AWS cloud computing, and radio interferometric search software. 2012 – 2019.
- Breakthrough Listen Interns
  Lectured and supervised individual projects. 2016 – 2018.

University of Amsterdam, Amsterdam, The Netherlands

Student Advising **2006 – 2007**

- **Thijs Coenen**
  Master's student at the University of Amsterdam building a machine learning algorithm for the automatic classification of radio transients detected by LOFAR. Primary adviser: Ralph Wijers. 2005.

Northwestern University, Evanston, IL

Teaching Assistant **2004**

- Taught weekly physics discussion session with roughly 100 students.

Observatory Host **2003 – 2006**

- Led open night tours of the historic Dearborn Observatory once per month.

Boston University, Boston, MA

Teaching Assistant **1999 – 2000**

- Taught four astronomy lab sections per semester (including night labs).

University of Hawaii at Manoa, Honolulu, HI

Co-organizer, Hawai'i Physics Olympics **1996 – 1998**

- Helped organize annual, state-wide event for high school students.
- Designed events to test understanding of physical concepts.

Co-organizer, Physics Tutoring **1996 – 1998**

- Created and participated in volunteer physics tutoring service for undergraduates.

Grants

Collaborator: Canadian Initiative for Radio Astronomy Data Analysis (CIRADA), Canada Foundation for Innovation, 2017

PI: Real-time, commensal transient detection at the VLA (*realfast* project), NSF, Advanced Technology and Instrumentation grant, awarded 2016.

Senior staff: Anomaly detection with fast imaging radio interferometers. University of California Office of the President grant, awarded 2012.

Co-I: A Coherent Transient Detection System for SKA Pathfinders. University of Western Australia Collaboration grant, awarded 2012.

PI: Meeting of LOFAR and the Transient Radio Sky. NWO and NOVA (NL) collaboration support grants, awarded 2008.

PI: Development of a spatio-spectral analysis technique for X-ray data. *Chandra* archival research grant, awarded 2003.

Professional Honors and Service

Member, NRAO Users Committee, 2019 – present

Reviewer for SARAO (MeerKAT), FAST telescope, NRAO, NASA and NSF, 2013 – present

Co-Chair of Working Group and Member of Survey Science Group for the VLA Sky Survey, 2014 – present

Editor, Astronomy and Computing, 2018 – 2019

Visitor, Dunlap Institute for Astronomy and Astrophysics, University of Toronto, July 2018

External Review Committee, CHIME/FRB project, 2017 – 2018

Organizer, Radio Astronomy Lab Hack day, 2017

Organizer, Berkeley Astronomy arxiv coffee, 2017 – 2019

Member, Berkeley Institute for Data Science, 2014 – 2019

Editor, Astronomy and Computing, 2018 – 2019

Visitor, Dunlap Institute, University of Toronto, July 2018

External Review Committee, CHIME FRB project, 2017 – 2018

Organizer, Radio Astronomy Lab Hack day, 2017

Developed and contributed to public astronomy software repositories: https://github.com/caseyjlaw, 2012 – present

Referee for the Astrophysical Journal, Astronomical Journal, MNRAS, PASP, and New Astronomy, 2006 – present

Jansky Very Large Array Resident Observer, 2012

Chair of LOC and member of SOC for "LOFAR and the Transient Radio Sky", 2008

Huang Fellowship at Northwestern University, 2002 – 2003

Two Presidential Fellowships (Research and Teaching) at Boston University, 1998 – 2000

Four merit-based tuition waivers from the Department of Physics at the University of Hawai'i, 1995 – 1998

Hawai'i Space Grant Fellowship, 1997

Select Publications

1. "A Distant Fast Radio Burst Associated with Its Host Galaxy by the Very Large Array", Law, C. J. et al. 2020, ApJ, 899, 161
2. "A Data-driven Technique Using Millisecond Transients to Measure the Milky Way Halo" Platts, E. et al. 2020, ApJ, 859, 49
3. "The Karl G. Jansky Very Large Array Sky Survey (VLASS). Science Case and Survey Design" Lacy, M. et al, PASP, 132
4. "A repeating fast radio burst source localized to a nearby spiral galaxy" Marcote, B. et al Nature, 577, 190
5. "A Search for Late-time Radio Emission and Fast Radio Bursts from Superluminous Supernovae" Law, C. J. et al 2019, ApJ, 886, 24
6. "Discovery of the Luminous, Decades-long, Extragalactic Radio Transient FIRST J141918.9+394036", Law, C. J. et al. 2018, ApJ, 866, L22
7. "Fast Radio Burst 121102 Pulse Detection and Periodicity: A Machine Learning Approach", Zhang, Y. G. et al 2018, ApJ, 866, 149
8. "Serendipitous Fast Transient Science with the ngVLA", Law, C. J. et al. 2018, "Science with a Next-Generation VLA", ed. E. J. Murphy (ASP, San Francisco, CA)
9. "Highest Frequency Detection of FRB 121102 at 4-8 GHz Using the Breakthrough Listen Digital Backend at the Green Bank Telescope", Gajjar, V. et al. 2018, ApJ, 863, 2

10. “The Nonhomogeneous Poisson Process for Fast Radio Burst Rates”, Lawrence, E. 2017, AJ, 154, 117

11. “A direct localization of a fast radio burst and its host”, Chatterjee, S. et al 2017, Nature, 541, 58

12. “The Repeating Fast Radio Burst FRB 121102 as Seen on Milliarcsecond Angular Scales”, Marcote, B. et al 2017, ApJ, 834, 8

13. “The Host Galaxy and Redshift of the Repeating Fast Radio Burst FRB 121102”, Tendulkar, S. et al, 2017, ApJ, 834, 7

14. “realfast: Real-time, Commensal Fast Transient Surveys with the Very Large Array”, Law, C.J. et al 2018, ApJS, 236, 8

15. “A Multi-telescope Campaign on FRB 121102: Implications for the FRB Population”, Law, C.J. et al 2017, ApJ, 850, 76

16. “LOFAR MSSS: detection of a low-frequency radio transient in 400 h of monitoring of the North Celestial Pole”, Stewart et al 2016, MNRAS, 46, 2321

17. “A Millisecond Interferometric Search for Fast Radio Bursts with the Very Large Array”, Law, C. J. et al 2015, ApJ, 807, 16

18. “The LOFAR Transients Pipeline”, Swinbank, J. D. et al, 2015, A&C 11, 25

19. “The LOFAR pilot surveys for pulsars and fast radio transients”, Coenen, T. et al 2014, A&A, 570, 60

20. “LOFAR: The LOw-Frequency ARray”, van Haarlem, M. et al 2013, A&A, 556, 2

21. “The RRAT Trap: Interferometric Localization of Radio Pulses from J0628+0909”, Law, C. J. et al 2012, ApJ, 760, 124

22. “All Transients, All the Time: Real-time Radio Transient Detection with Interferometric Closure Quantities”, Law, C. J. et al 2012, ApJ, 749, 143

23. “Millisecond Imaging of Radio Transients with the Pocket Correlator”, Law, C. J. et al 2011, ApJ, 742, 12

24. “Spectropolarimetry with the Allen Telescope Array: Faraday Rotation toward Bright Polarized Radio Galaxies”, Law, C. J. et al 2011, ApJ, 728, 57

25. “A Constraint on the Organization of the Galactic Center Magnetic Field Using Rotation Measures”, Law, C. J. et al 2011, ApJ, 731, 36

26. “Observing pulsars and fast transients with LOFAR”, Stappers, B. W. et al 2011, A&A, 530, 80

27. “Wild at Heart: The Particle Astrophysics of the Galactic Centre”, Crocker, R. M. et al., 2011, MNRAS, 413, 763

28. “The Allen Telescope Array Pi GHz Sky Survey I. Survey Description and Static Catalog Results for the Bootes Field”, Bower, G. C. et al., 2010, ApJ, 725, 1792

29. “The Allen Telescope Array Twenty-centimeter Survey – A 690 sq-deg, 12 Epoch Radio Data Set. I. Catalog and Long-duration Transient Statistics”, Croft, S. et al. 2010, ApJ, 719, 45

30. “A Multiwavelength View of a Mass Outflow from the Galactic Center”, Law, C. J. 2010, ApJ, 708, 474

31. “Green Bank Telescope Multiwavelength Survey of the Galactic Center Region”, Law, C. J., et al. 2008, ApJS, 177, 255

32. “X-Ray Observations of Stellar Clusters Near the Galactic Center”, Law, C. & Yusef-Zadeh, F. 2004, ApJ, 611, 858

33. “Detection of X-Ray Emission from the Arches Cluster near the Galactic Center”, Yusef-Zadeh, F., Law, C., et al. 2002, ApJ, 570, 665

Software

1. “rfpipe: Radio interferometric transient search pipeline”, Law, C. J. 2017, ASCL, 1710.002

2. “vysmaw: Fast visibility stream muncher”, Pokorny, M. & Law, C. J. 2017, ASCL, 1710.001

3. “rtpipe: Searching radio interferometry data for fast, dispersed transients”, Law, C. J. 2017, ASCL, 1706.002

4. “tpipe: Searching radio interferometry data for fast, dispersed transients”, Law, C. J. 2016, ASCL, 1603.012