CATHERINE ZUCKER

Astrophysicist, Smithsonian Astrophysical Observatory
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RESEARCH INTERESTS

Galactic structure/dynamics, star formation, interstellar medium, stellar populations, big data, data visualization

RESEARCH POSITIONS

Federal Astrophysicist, Smithsonian Astrophysical Observatory — Summer 2023–Present
Lecturer, Harvard University
Senior Member, Institute for Theory and Computation at Harvard University
Hubble Fellow, Space Telescope Science Institute — Fall 2021–Summer 2023
Postdoctoral Fellow, Center for Astrophysics | Harvard & Smithsonian — Summer 2020–Summer 2021

EDUCATION

Harvard University: PhD in Astronomy — 2017–2020
Advisors: Alyssa Goodman & Douglas Finkbeiner
Dissertation: *Charting our Uncharted Milky Way*
Harvard University: MA in Astronomy — 2015–2017
University of Virginia: BA in Astronomy–Physics & History — 2011–2015

SELECTED AWARDS & HONORS

NSF CAREER Award — Spring 2025
Bart J. Bok Prize Lectureship — Spring 2024
Awarded to a recent Harvard PhD recipient for observational research of the Milky Way
Astronomy Magazine Top 25 Rising Star — Fall 2022
NASA Hubble Fellowship Program Hubble Fellowship — Fall 2021
Protostars & Planets VII (PPVII) Chapter Lead — Fall 2020
Led review chapter for PPVII meeting
Fireman Fellow, Harvard Astronomy — Spring 2020
Department's highest honor, awarded to a single graduating PhD student for their doctoral work
Harvard–Horizons Scholar — Spring 2020
Top eight graduate students selected across Harvard to receive professional development training, culminating in public "TED–style" talk
Department of Astronomy Teaching Award (Harvard) — Spring 2018
Bok Center Certificate of Distinction in Teaching (Harvard) — Fall 2017, Spring 2019
La Serena School for Data Science Full Scholarship — Summer 2017
NSF Graduate Research Fellowship — Fall 2016
Pierce Fellowship (Harvard Astronomy) — Fall 2015
Fellowship for top three admitted Harvard Astronomy applicants
Merrill Graduate Fellowship (Harvard) — Fall 2015

PUBLICATIONS

I have co–authored **60 publications** with > **2800** citations. See ADS for a full list. Highlights include:
14 papers as first author/co–PI (> 900 citations), including 1 *Nature* publication and 1 review paper
22 papers as second or third author with significant contributions, including 2 *Nature* publications
7 papers led by students, for which I served as a primary science advisor or joint co–advisor (denoted by *)

1st author/co–PI:

1. **Zucker, C.**, & Saydjari, A., & Speagle, J., Schlafly, E., Green, G., Peek, J., Edenhofer, G., Goodman, A., Kuhn, M., and Finkbeiner, D. *ApJ*, Submitted. 2025. A Deep, High-Angular Resolution 3D Dust Map of the Southern Galactic Plane.
2. **Zucker, C.**, Redfield, S., Starecheski, S., Konietzka, R., Linsky, J. 2025. *ApJ*, Submitted. The Origin of the Cluster of Local Interstellar Clouds.
3. **Zucker, C.**, Alves, J., Goodman, A., Meingast, S., and Galli, P. 2023. *Protostars and Planets VII*, ASP Conference Series, Vol. 534. The Solar Neighborhood in the Age of *Gaia*.
4. **Zucker, C.**, Peek, J., and Loebman, S., 2022. *ApJ*, 936, 160. Disconnecting the Dots: Re-examining the Nature of Stellar "Strings" in the Milky Way.
5. **Zucker, C.**, Goodman, A., Alves, J., Bialy, S., Foley, M., Speagle, J., Grossschedl, J., Finkbeiner, D., Burkert, A., Khimey, D., Swiggum, C. 2022. *Nature*. Star Formation Near the Sun is Driven by Expansion of the Local Bubble.
6. **Zucker, C.**, Goodman, A., Alves, J., Bialy, S., Koch, E., Speagle, J., Foley, M., Finkbeiner, D., Leike, R., Ensslin, T., Peek, J., and Edenhofer, G. 2021. *ApJ*, 919, 35. On the Three-Dimensional Structure of Local Molecular Clouds.
7. **Zucker, C.**, Speagle, J., Schlafly, E., Green, G., Finkbeiner, D., Goodman, A., Alves, J. 2020. A&A. 633, A51. A Compendium of Distances to Molecular Clouds in the Star Formation Handbook.
8. **Zucker, C.**, Smith, R., Goodman, A. 2019. *ApJ*, 887, 186. Synthetic Large-Scale Galactic Filaments — on their Formation, Physical Properties, and Resemblance to Observations.
9. **Zucker, C.** & Speagle, J, Schlafly, E., Green, G., Finkbeiner, D., Goodman, A., Alves, J. 2019. *ApJ*, 879, 125. A Large Catalog of Accurate Distances to Local Molecular Clouds: The Gaia DR2 Edition.
10. **Zucker**, C., Schlafly, E., Green, G., Speagle, J., Portillo, S., Finkbeiner, D., Goodman, A. 2018. *ApJ*, 869, 83. Mapping Distances across the Perseus Molecular Cloud Using CO Observations, Stellar Photometry, and Gaia DR2 Parallax Measurements.
11. **Zucker**, C. & Chen, H. H. 2018. *ApJ*, 864, 162. RadFil: A Python Package for Building and Fitting Radial Profiles for Interstellar Filaments.
12. **Zucker, C.**, Battersby, C., Goodman, A. 2018. *ApJ*, 864, 2. The Physical Properties of Large-scale Galactic Filaments.
13. **Zucker, C.**, Walker, L.M., Johnson, K., Gallagher, S., Alatalo, K., Tzanavaris, P. 2016. *ApJ*, 821, 113. Hierarchical Formation in Action: Characterizing Accelerated Galaxy Evolution in Compact Groups using Whole-Sky WISE Data.
14. **Zucker, C.**, Battersby, C., Goodman, A. 2015. *ApJ*, 815, 23. The Skeleton of the Milky Way.

Second or Third Author:

15. *Gao, Bore (Annie), **Zucker, C.**, [14 co-authors]. 2025. *ApJ*, Submitted. Origin of the IRAS Vela Shell: New Insights from 3D Dust Mapping.
16. Speagle, J., **Zucker, C.** [17 authors]. 2025, *ApJ*, Submitted. Deriving Stellar Properties, Distances, and Reddenings from Photometry and Astrometry with *brutus*.
17. Panopoulou, G., **Zucker, C.** Clemens, D., Pelgrims, V., Soler, J., Clark, S., Alves, J., Goodman, A., Tjus, J. 2024. *A&A*, 694, A97. The magnetic field of the Radcliffe Wave: starlight polarization at nearest approach to the Sun.
18. *O'Neill, T., **Zucker, C.**, Goodman, A., and Edenhofer, G. 2024. *ApJ*, 973, 136. The Local Bubble is a Local Chimney: A New Model from 3D Dust Mapping.
19. Opher, M., Loeb, A., **Zucker, C.**, [9 co-authors]. 2024, *ApJ*, 972, 201. The Passage of the Solar System through the Edge of the Local Bubble.
20. Speagle, J., **Zucker, C.** [17 authors]. 2024. *ApJ*, 970, 121. Mapping the Milky Way in 5-D with 170 Million Stars at High Galactic Latitudes.
21. Edenhofer, G., Alves, J. **Zucker, C.**, Ensslin, T, and Posch, L. 2024. *A&A*, 687, L9. The "C": The large Chameleon-Musca-Coalsack Cloud.
22. *Mullens, E., **Zucker, C.**, Murray, C., and Smith, R. 2024. *ApJ*, 966, 127. Characterizing the 3D Structure of Molecular Cloud Envelopes in the Cloud Factory Simulations.
23. *Konietzka, R., Goodman, A., **Zucker, C.**, Burkert, A., Alves, J. Foley, M., and Swiggum, C. 2024, *Nature*, 628, 62. The Radcliffe Wave is Oscillating.
24. *Cahlon, S., **Zucker, C.**, Goodman, A., Lada, C., Alves, J. 2024. *ApJ*, 961, 153. A Parsec-Scale Catalog of Molecular Clouds in the Solar Neighborhood Based on 3D Dust Mapping: Implications for the Mass-Size Relation.
25. Edenhofer, G., **Zucker, C.**, Frank, P., Saydjari, A., Speagle, J., Finkbeiner, D., and Ensslin, T. 2024. *A&A*, 685, 82. A Parsec-Scale Galactic 3D Dust Map out to 1.25 kpc from the Sun.
26. Soler, J., **Zucker, C.**, Peek, J. [14 co-authors]. 2023, *A&A*, 675, A206. A panoptic view of the Taurus molecular cloud.
27. Saydjari, A., Uszoy, A.S., **Zucker, C.**, Peek, J., Finkbeiner, D. 2023, *ApJ*, 954, 141. Measuring the 8623Å Diffuse Interstellar Band in *Gaia* DR3 RVS Spectra: Obtaining a Clean Catalog by Marginalizing over Stellar Types.
28. Foley, M., Goodman, A., **Zucker, C.** [11 co-authors]. 2022. *ApJ*, 947, 66. A 3D View of Orion: I. Barnard's Loop.

29. *Tu, A., **Zucker, C.**, Speagle, J., Beane, A., Goodman, A., Alves, J., Faherty, J., and Burkert, A. 2022, *ApJ*, 936, 57. Characterizing the 3D Kinematics of Young Stars in the Radcliffe Wave.
30. Stephens, I., Myers, P., **Zucker, C.** [21 co-authors]. 2022. *ApJL*, 96, 6. The Magnetic Field in the Milky Way Filamentary Bone G47.
31. Bialy, S., **Zucker, C.**, Goodman, A., Foley, M., Alves, J., Semenov, V., Leike, R., Ensslin, T. 2021. *ApJL*, 919, L5. The Per-Tau Shell: A Giant Star-forming Spherical Shell Revealed by 3D Dust Observations.
32. Kuhn, M., Benjamin, R., **Zucker, C.**, Krone-Martins, A., de Souza, R., Castro-Ginard, A., Ishida, E., Povich, M., Hillenbrand, L. 2021, *A&A*, 651, L10. A High Pitch Angle Structure in the Sagittarius Arm.
33. *Das, K., **Zucker, C.**, Speagle, J., Goodman, A., Green, G., and Alves, J. 2020. *MNRAS*. 498, 4. Constraining the Distance to the North Polar Spur with Gaia DR2.
34. Alves, J., **Zucker, C.**, Goodman, A., Speagle, J., Meingast, S., Robitaille, T., Finkbeiner, D., Schlafly, E., Green, G. 2020. *Nature*, 578, 237. A Galactic-scale gas wave in the Solar Neighborhood.
35. Green, G., Schlafly, E., **Zucker, C.**, Speagle, J., Finkbeiner, D. 2019. MNRAS, 887, 93. A 3D Dust Map Based on Gaia, Pan-STARRS 1 and 2MASS.
36. Lisenfeld, U., Alatalo, K., **Zucker, C.**, Appleton, P. N., Gallagher, S., Guillard, P., Johnson, K. 2017. *A&A*, 607, A110. The Role of Molecular Gas in Galaxy Transition in Compact Groups.

Other Co-Authored Publications:

37. Opher, M., Giacalone, J., Loeb, A., Economo, E., Cummings, A., Middleton, J., **Zucker, C.**, Miller, J., Nica, A., Hatzaki, M. *PNAS*, Submitted. 2025. Heliospheric Dynamics Driving Increased and Varied Radiation Exposure of Earth 2-3 million years ago.
38. Van-Lane, P., Speagle, J., Eadie, G., Douglas, S., Cargile, P., **Zucker, C.**, Lu, Y., and Angus, R., 2025. *ApJ*, Submitted. ChronoFlow: A Data-Driven Model for Gyrochronology.
39. Soler, J. and 12 co-authors, including **Zucker C.** 2025. *A&A*, Submitted. Kinetic tomography of the Galactic plane within 1.25 kiloparsecs from the Sun. The interstellar flows revealed by HI and CO line emission and 3D dust.
40. O'Neill, T., Goodman, A., Soler, J., **Zucker, C.**, Han, J. 2025. *ApJ*, Submitted. A 3D Model of the Local Bubble's Magnetic Field: Insights from Dust and Starlight Polarization.
41. Maconi, E., and 16 co-authors, including **Zucker, C.**, *A&A*, 684, 167. The Solar System's passage through the Radcliffe wave during the middle Miocene.
42. Anderson, L., Benjamin, R., Hurley-Walker, N., McClure-Griffiths, N., Luisi, M., Liu, B., Linville, D., **Zucker, C.**, and Kuhn, M. 2024. *ApJ*, 969, 43. The Galactic Center Lobe as an HII Region.
43. Hurley-Walker, N., Anderson, L., Luisi, M., McClure-Griffiths, N., Benjamin, R., Kuhn, M., Linville, D., Liu, B., **Zucker, C.** 2024. *ApJ*, 969, 42. Low-frequency absorption and radio recombination line features of the Galactic Center Lobe.
44. Swiggum, C. and 11 co-authors, including **Zucker, C.** 2024. *Nature*, 631, 49. Most nearby young clusters formed in three massive complexes.
45. Posch, L and and 7 co-authors, including **Zucker, C.** 2023. *A&A*, 679, L10. The Corona Australis star formation complex is accelerating away from the Galactic plane.
46. Ratzenbock, S. and 15 co-authors, including **Zucker, C.** 2023. *A&A*. 678, A71. The star formation history of the Sco-Cen association. Coherent star formation patterns in space and time.
47. Meingast, S. & 37 co-authors, including **Zucker, C.** 2023. *A&A*, 673, A58. VISIONS: The VISTA Star Formation Atlas I: Survey Overview.
48. Saydjari, A & 12 co-authors, including **Zucker, C.** 2023. *ApJS*, 264, 28. The Dark Energy Camera Plane Survey 2 (DECaPS2): More Sky, Less Bias, and Better Uncertainties.
49. Kuhn, M. & 10 co-authors, including **Zucker, C.** 2022. *AJ*, 165, 3. Spectroscopic Confirmation of a Population of Isolated, Intermediate-Mass YSOs.
50. Swiggum, C., Alves, J., D'Onghia, E., Benjamin, R., Thulasidharan, L., **Zucker, C.**, Poggio, E., Drimmel, R., Gallagher, J., and Goodman, A. 2022, *A&A*, 664, 13. The Radcliffe Wave as the Gas Spine of the Orion Arm.
51. Grasser, N., Ratzenbock, S., Alves, J., Grossschedl, J., Meingast, S., **Zucker, C.**, Hacar, A., Lada, C., Goodman, A., Lombardi, M., Forbes, J., Bomze, I., and Moller, T., 2021. *A&A*, 652, A2. The ρ Oph region revisited with Gaia EDR3: Two young populations, new members, and old impostors.
52. Swiggum, C., D'Onghia, E., Alves, J., Grossschedl, J., Foley, M., **Zucker, C.**, Meingast, S., Chen, B., Goodman, A. 2021. *ApJ*, 917, 21. Evidence for Radial Expansion at the Core of the Orion Complex with Gaia EDR3.

53. Kong, S., Arce, H., Carpenter, J., [9 authors], **Zucker, C.**, [5 authors]. 2021. *AJ*, 161, 229. High-resolution CARMA Observations of Molecular Gas in the North America and Pelican Nebulae.
54. Green, G., Rix, H-W., Tschesche, L., Finkbeiner, D., **Zucker, C.**, Schlafly, E., Rybizki, J., and Speagle, J. 2021. *ApJ*, 907, 57. Data-Driven Stellar Models.
55. Izquierdo, A., Smith, R., Glover, S., Klessen, R., Treß, R., Sormani, M., Clark, P., Duarte-Cabral, A., and **Zucker, C.** 2021. *MNRAS*, 500, 5286. The Cloud Factory II: Gravoturbulent Line-Widths of Resolved Molecular Clouds in a Galactic Potential.
56. Wang, Y., Beuther, H., Schneider, N., Meidt, S., Linz, H., Ragan, S., **Zucker, C**, Battersby, C., Soler, J., Schinnerer, E., Bigiel, F., Colombo, D. and Henning T. 2020. *A&A*, 641, A53. Dense Gas in a Giant Molecular Filament.
57. Smith, R. J., Tress, R., Sormani, C., Clover, S. Klessen, R., Clark, P., Izquierdo, A., Duarte-Cabral, A., **Zucker, C.** 2019. *MNRAS*, 492, 1594. The Cloud Factory I: Generating resolved filamentary molecular clouds from galactic-scale forces.
58. Fissel, L. & 39 co-authors, including **Zucker, C.** 2019. *ApJ*, 878, 110. Relative Alignment between the Magnetic Field and Molecular Gas Structure in the Vela C Giant Molecular Cloud Using Low- and High- density Tracers.
59. Monsch, K., Pineda, J., Liu, H.B., **Zucker, C.**, H., Chen, H., Pattle, K., Offner, S., Di Francesco, J., Ginsburg, A., Ercolano, B., Arce, H., Friesen, R., Kirk, H., Caselli, P., Goodman, A. 2018. *ApJ*, 861, 77. Dense Gas Kinematics and a Narrow Filament in the Orion A OMC1 Region using NH3.
60. Walker, L.M., Butterfield, N., Johnson, K., **Zucker, C.**, Gallagher, S., Konstantopoulos, I., Hornschemeier, A., Tzanavaris, P., Charlton, J. 2013. *ApJ*, 775,129. The Optical Green Valley vs Mid-IR Canyon in Compact Groups.

ADVISING

I have served as a (co-)advisor for **fourteen students**, resulting in seven student-led refereed publications:

Graduate students:

Caleb Levy (Harvard)	Fall 2024–Present
Theo O'Neill (Harvard)	Fall 2023–Present
Annie Gao (SAO Predoctoral Fellow/JHU)	Fall 2022–Present
Ralf Konietzka (Harvard)	Fall 2023–Summer 2024

Undergraduate students:

Abigail Bohl (Cornell)	Summer 2024–Present
Stephanie Yoshida (Harvard)	Fall 2023–Winter 2024
Elijah Mullens (University of Florida)	Spring 2022–Winter 2024
Shlomo Cahlon (Harvard)	Fall 2020–Fall 2023
Sara Starecheski (Sarah Lawrence College)	Summer 2022–Summer 2023
Victoria Ono (Harvard)	Fall 2022–Winter 2022
Diana Khimey (Harvard)	Winter 2020–Summer 2021
Alan Tu (Harvard)	Summer 2020–Spring 2022
Kaustav Das (IIT Kanpur)	Summer 2019–Fall 2020
Laura Chapman (Harvard)	Summer 2018

PRESENTATIONS

I have given **72 talks**, including **51 invited** colloquia, seminars, and conference talks. Highlights include:

Colloquia (Selected):

CfA | Harvard & Smithsonian	November 2024
Cornell University	October 2024
Heidelberg Joint Astronomy	July 2024
Pennsylvania State University	March 2024
University of Toronto	March 2024
NRAO Socorro	December 2023
UCLA	October 2023
Australian National University	May 2023
EPFL/University of Geneva	December 2022
NASA Goddard Spaceflight Center	October 2022
Max Planck Institute for Radioastronomy	September 2022

Durham University May 2022
University of Vienna April 2022
Carnegie Observatories March 2022

Recent Invited Seminars:
Boston University December 2023
University of Utah October 2023
University of Pennsylvania February 2023

Recent Invited Conference Talks:
AAS 244 Meeting-in-Meeting June 2024
Salpeter Workshop on the Diffuse Interstellar Medium (Cornell) December 2023
Surveying the Milky Way (IPAC) October 2023

SELECTED PROFESSIONAL ACTIVITIES

Conference and Seminar Organization:
SOC, Roman Galactic Plane Survey Workshop Winter 2025
SOC, STScI Spring Symposium, Inter+Stellar Spring 2025
SOC, Galactic Science with the Nancy Grace Roman Telescope, Yerkes Observatory Spring 2024
Chair, AAS 243 Special Session: The Future of Galactic Plane Science with Roman Winter 2024
SOC, New Computational Methods in Milky Way Structure and Dynamics Winter 2024
SOC, Early Phases of Star Formation (EPoS) 2024 Meeting Fall 2023
SOC, Mapping the Milky Way at the Lorentz Center Winter 2023
Organizer, Low Density Universe Meetings at STScI/JHU Fall 2022 – Spring 2023
SOC Chair, *Seeing the Future* Conference Spring 2022
Interdisciplinary conference at the intersection of astronomy/data/education/digital scholarship
Harvard Star Formation Journal Club Series Co-Organizer Spring 2018-Spring 2020
SOC, Harvard-Heidelberg Meeting on Star Formation Fall 2017, Fall 2019, Fall 2023

Committees, Collaborations, & Leadership:
Roman Galactic Plane Survey Definition Committee Member July 2024-Present
CfA/Clay Fellowship Selection Committee Fall 2023, Fall 2024
CfA Decadal Survey Editorial Board Fall 2023-Present
SDSS-V Dust Program Working Group Co-Chair Summer 2022-Present
AAS WorldWide Telescope Software Steering Committee Fall 2021 – Winter 2023
Harvard Data Science Review, Emerging Scholars Board Spring 2020-Fall 2022
Co-Investigator, DECam Galactic Plane Survey Fall 2018 – Fall 2023
Core member, glue visualization software team Spring 2017-Present

Reviewing:
LMT External Proposal Reviewer Fall 2023
Guest Editor, Annual Review of Astronomy & Astrophysics (ARAA, Volume 63) Spring 2023
NASA Astrophysics Data Analysis Program (ADAP) Panel Reviewer Summer 2022
NSF Astronomy & Astrophysics Research Grants (AAG) Panel Reviewer Spring 2021
Referee for ApJ, A&A, AJ, & MNRAS Fall 2018 – Present

SELECTED OUTREACH & MENTORING

Benjamin Dean Lecture, California Academy of Sciences Summer 2024
Mentor, CfA Constellations Mentoring Program Spring 2024-Present
Astronomy Live Show at AMNH Hayden Planetarium, Mapping the Milky Way in 3D December 2023
Sky & Telescope Guest Writer Summer 2023
Article on *Mapping our Galactic Backyard*
Mentor, Astronomy Mentorship Program for Upcoming Postdocs (AMP-UP) Spring 2022-Summer 2024
Subject Matter Expert, NASA Cosmic Data Stories Fall 2020 – Present

Public understanding of data science via interactive research stories

WorldWide Telescope Ambassador — Fall 2015 – Present
Cambridge Explores the Universe Volunteer — Spring 2016, 2017, 2018, 2019, 2023, 2024
Public Talks throughout New England — Spring 2018–Present
Astronomy Rewind, Volunteer Lead — Fall 2018

SELECTED PRESS

My research has been featured in over one hundred news outlets worldwide including The Associated Press, The Wall Street Journal, The New York Times, CNN, BBC News and The Guardian. Highlights include:

New York Times, *Where our Bubble Ends, Our Understanding Begins* — January 2022
NBC News, *Booms and a Bubble: How Supernovae Shaped our Galactic Neighborhood* — January 2022
CBC Radio Interview, Quirks and Quarks — January 2022
NPR Radio Interview, Science Friday — January 2020
The Associated Press, *Titanic Wave of Star-forming Gases Found in the Milky Way* — January 2020