

# 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

Astrophysicist, Smithsonian Astrophysical Observatory (Permanent, Federal)	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: <i>Charting our Uncharted Milky Way</i>	
Harvard University: MA in Astronomy	2015–2017
University of Virginia: BA in Astronomy–Physics & History	2011–2015

## SELECTED AWARDS & HONORS

Bart J. Bok Prize Lectureship	Spring 2024
Awarded to a recent Harvard PhD recipient for observational research of the Milky Way	
<a href="#">Astronomy Magazine Top 25 Rising Star</a>	Fall 2022
NASA Hubble Fellowship Program Hubble Fellowship	Fall 2021
Protostars & Planets VII (PPVII) Chapter Lead	Fall 2020
Competitively selected to lead review chapter for PPIII 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 52 publications with > 2000 citations. See [ADS](#) for a full list. Highlights include:

12 papers as first author/co–PI (> 800 citations), including 1 *Nature* publication and 1 review paper

21 papers as second or third author with significant contributions, including 2 *Nature* publications

6 papers led by students, for which I served as a primary science advisor or joint co–advisor (denoted by \*)

1<sup>st</sup> author/co–PI:

1. 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](#).
2. 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](#).
3. 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](#).
4. 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](#).
5. 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](#).
6. Zucker, C., Smith, R., Goodman, A. 2019. *ApJ*, 887, 186. [Synthetic Large-Scale Galactic Filaments — on their Formation, Physical Properties, and Resemblance to Observations](#).
7. 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](#).
8. 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](#).
9. Zucker, C. & Chen, H. H. 2018. *ApJ*, 864, 162. [RadFil: A Python Package for Building and Fitting Radial Profiles for Interstellar Filaments](#).
10. Zucker, C., Battersby, C., Goodman, A. 2018. *ApJ*, 864, 2. [The Physical Properties of Large-scale Galactic Filaments](#).
11. 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](#).
12. Zucker, C., Battersby, C., Goodman, A. 2015. *ApJ*, 815, 23. [The Skeleton of the Milky Way](#).

## Second or Third Author:

13. Panopoulou, G., Zucker, C., Clemens, D., Pelgrims, V., Soler, J., Clark, S., Alves, J., Goodman, A., Tjus, J. *A&A*, Submitted. [The magnetic field of the Radcliffe Wave: starlight polarization at nearest approach to the Sun](#).
14. Edenhofer, G., Alves, J., Zucker, C., Ensslin, T., and Posch, L. 2024. *A&A*, Submitted. [The “C”: The large Chameleon–Musca–Coalsack Cloud](#).
15. \*O’Neill, T., Zucker, C., Goodman, A., and Edenhofer, G. 2024. *ApJ*, Submitted. [The Local Bubble is a Local Chimney: A New Model from 3D Dust Mapping](#).
16. Opher, M., Loeb, A., Zucker, C., [9 co-authors]. 2024, *ApJ*, Accepted. [The Passage of the Solar System through the Local Bubble](#).
17. Speagle, J., Zucker, C. [17 authors]. 2024, *ApJ*, Submitted. [Deriving Stellar Properties, Distances, and Reddenings from Photometry and Astrometry with brutus](#).
18. Speagle, J., Zucker, C. [17 authors]. 2024. *ApJ*, Accepted. [Mapping the Milky Way in 5-D with 170 Million Stars at High Galactic Latitudes](#).
19. \*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](#).
20. \*Konietzka, R., Goodman, A., Zucker, C., Burkert, A., Alves, J., Foley, M., and Swiggum, C. 2024, *Nature*. [The Radcliffe Wave is Oscillating](#).
21. \*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](#).
22. Edenhofer, G., Zucker, C., Frank, P., Saydjari, A., Speagle, J., Finkbeiner, D., and Ensslin, T. 2024. *A&A*, Accepted. [A Parsec-Scale Galactic 3D Dust Map out to 1.25 kpc from the Sun](#).
23. Soler, J., Zucker, C., Peek, J. [14 co-authors]. 2023, *A&A*, 675, A206. [A panoptic view of the Taurus molecular cloud](#).
24. 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](#).
25. Foley, M., Goodman, A., Zucker, C. [11 co-authors]. 2022. *ApJ*, 947, 66. [A 3D View of Orion: I. Barnard’s Loop](#).
26. \*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](#).
27. Stephens, I., Myers, P., Zucker, C. [21 co-authors]. 2022. *ApJL*, 96, 6. [The Magnetic Field in the Milky Way Filamentary Bone G47](#).
28. 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](#).

29. 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.](#)
30. \*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.](#)
31. 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.](#)
32. 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.](#)
33. 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:

34. Anderson, L., Benjamin, R., Hurley-Walker, N., McClure-Griffiths, N., Luisi, M., Liu, B., Linville, D., Zucker, C., and Kuhn, M. 2024. *ApJ*, Accepted. [The Galactic Center Lobe as an HII Region.](#)
35. Hurley-Walker, N., Anderson, L., Luisi, M., McClure-Griffiths, N., Benjamin, R., Kuhn, M., Linville, D., Liu, B., Zucker, C. 2024. *ApJ*, Accepted. [Low-frequency absorption and radio recombination line features of the Galactic Center Lobe.](#)
36. Swiggum, C. and 11 co-authors, including Zucker, C. *Nature*, Accepted. [Most nearby young clusters formed in three massive complexes.](#)
37. Posch, L. and 7 co-authors, including Zucker, C. *A&A*, 679, L10. [The Corona Australis star formation complex is accelerating away from the Galactic plane.](#)
38. Ratzenbock, S. and 15 co-authors, including Zucker, C. *A&A*, 678, A71. [The star formation history of the Sco-Cen association. Coherent star formation patterns in space and time.](#)
39. Meingast, S. & 37 co-authors, including Zucker, C. *A&A*, 673, A58. [VISIONS: The VISTA Star Formation Atlas I: Survey Overview.](#)
40. Saydjari, A & 12 co-authors, including Zucker, C. *ApJS*, 264, 28. [The Dark Energy Camera Plane Survey 2 \(DECaPS2\): More Sky, Less Bias, and Better Uncertainties.](#)
41. Kuhn, M. & 10 co-authors, including Zucker, C. 2022. *AJ*, 165, 3. [Spectroscopic Confirmation of a Population of Isolated, Intermediate-Mass YSOs.](#)
42. 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.](#)
43. 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  \$\rho\$  Oph region revisited with Gaia EDR3: Two young populations, new members, and old impostors.](#)
44. 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.](#)
45. 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.](#)
46. 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.](#)
47. 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.](#)
48. 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.](#)
49. 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.](#)
50. 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.](#)
51. 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 NH<sub>3</sub>.](#)
52. 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 **thirteen students**, resulting in six student-led refereed publications:

### Graduate students:

Theo O'Neill (Harvard)	Fall 2023–Present
Annie Gao (JHU/SAO Predoctoral Fellow)	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 **69 talks**, including **48 invited** colloquia, seminars, and conference talks. Highlights include:

### Colloquia (Selected):

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 (Selected):

Boston University	December 2023
University of Utah	October 2023
University of Pennsylvania	February 2023

### Recent Invited Conference Talks (Selected):

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, 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

**Reviewing:**

LMT External Proposal Reviewer

Fall 2023

Guest Editor, Annual Review of Astronomy &amp; Astrophysics (ARAA, Volume 63)

Spring 2023

NASA Astrophysics Data Analysis Program (ADAP) Panel Reviewer

Summer 2022

NSF Astronomy &amp; Astrophysics Research Grants (AAG) Panel Reviewer

Spring 2021

Referee for ApJ, A&amp;A, AJ, &amp; MNRAS

Fall 2018 – Present

**Committees, Collaborations, & Leadership:**

CfA/Clay Fellowship Selection Committee

Fall 2023

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

**SELECTED OUTREACH & MENTORING**

Mentor, CfA Constellations Mentoring Program

Spring 2024

*Astronomy Live* Show at AMNH Hayden Planetarium, Mapping the Milky Way in 3D

December 2023

Sky &amp; Telescope guest writer

Summer 2023

Article on *Mapping our Galactic Backyard*

Mentor, Astronomy Mentorship Program for Upcoming Postdocs (AMP–UP)

Spring 2022–Present

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

Public Talks throughout New England

Spring 2018–Present

Astronomy Rewind, Volunteer Lead

Fall 2018

**TEACHING**

I have served as a teaching fellow for an undergraduate and graduate course. Both times, I received the Harvard Bok Center Certificate of Distinction in Teaching, based on high student course evaluations. I also received the Harvard Astronomy departmental award for teaching excellence.

Physics &amp; Chemistry of the Interstellar Medium (Harvard University)

Spring 2019

Galactic &amp; Extragalactic Astronomy (Harvard University)

Fall 2017

**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