CATHERINE ZUCKER

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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 — Summer 2023–Present
  Senior Member, Institute for Theory and Computation at Harvard
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

Astronomy Magazine Top 25 Rising Star — 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 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 **42 publications** with **> 1500** citations. See ADS for a full list. Highlights include:
12 papers as first author/co-PI (> 600 citations), including 1 *Nature* publication and 1 review paper
14 papers as second or third author with significant contributions, including 1 *Nature* publication
2 papers led by students, for which I served as the primary science advisor (denoted by *)

1st 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. Konietzka, R., Goodman, A., **Zucker, C.**, Burkert, A., Alves, J. Foley, M., and Swiggum, C. 2023, *Nature*, Submitted. The Radcliffe Wave is Oscillating.
14. Opher, M., Loeb, A., **Zucker, C.**, [9 co-authors]. 2023, *ApJ*, Submitted. The Passage of the Solar System through the Local Bubble.
15. Soler, J., **Zucker, C.**, Peek, J. [14 co-authors]. 2023, *A&A*, Submitted. A panoptic view of the Taurus molecular cloud.
16. Saydjari, A., Uszoy, A., **Zucker, C.**, Peek, J., Finkbeiner, D. 2023, *ApJ*, Submitted. Measuring the 8623Å Diffuse Interstellar Band in *Gaia* DR3 RVS Spectra: Obtaining a Clean Catalog by Marginalizing over Stellar Types.
17. Foley, M., Goodman, A., **Zucker, C.** [11 co-authors]. 2022. *ApJ*, 947, 66. A 3D View of Orion: I. Barnard's Loop.
18. *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.
19. Stephens, I., Myers, P., **Zucker, C.** [21 co-authors]. 2022. *ApJL*, 96, 6. The Magnetic Field in the Milky Way Filamentary Bone G47.
20. 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.
21. 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.
22. Speagle, J., **Zucker, C.** [17 authors]. 2021. *ApJ,* Accepted. Mapping the Milky Way in 5-D with 170 Million Stars at High Galactic Latitudes.
23. Speagle, J., **Zucker, C.** [17 authors]. 2021, *ApJ*, Submitted. Deriving Stellar Properties, Distances, and Reddenings from Photometry and Astrometry with brutus.
24. *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.
25. 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.
26. 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.
27. 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:

28. Meingast, S. & 37 co-authors, including **Zucker, C.** *A&A*, 673, A58. VISIONS: The VISTA Star Formation Atlas I: Survey Overview.

29. 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.
30. Kuhn, M. & 10 co-authors, including **Zucker, C.** 2022. *AJ*, 165, 3. Spectroscopic Confirmation of a Population of Isolated, Intermediate-Mass YSOs.
31. 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.
32. Anderson, L., Benjamin, R., Hurley-Walker, N., McClure-Griffiths, N., Luisi, M., Liu, B., Linville, D., **Zucker, C.**, and Kuhn, M. 2021. *ApJ*, Submitted. The Galactic Center Lobe is a Foreground HII Region.
33. 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.
34. 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.
35. 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.
36. 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.
37. 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.
38. 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.
39. 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.
40. 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.
41. 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.
42. 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.

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 & Chemistry of the Interstellar Medium (Harvard University) Spring 2019
Galactic & Extragalactic Astronomy (Harvard University) Fall 2017

ADVISING

I have served as the primary science advisor or co-advisor for **nine students**:

Annie Gao (Graduate, Johns Hopkins) Fall 2022-Present
Triggered Star Formation in the Gum Nebula

Victoria Ono (Undergraduate, Harvard) Fall 2022-Winter 2022
Exploring the 3D Velocity Dispersions of Young Stellar Clusters

Elijah Mullens (Postgraduate, University of Florida; *now PhD student at Cornell*) Spring 2022-Present
Unveiling the Nature of Diffuse Interstellar Envelopes around Nearby Dense Clouds

Sara Starecheski (Undergraduate, Sarah Lawrence College) Summer 2022-Present
Modeling the Origin and Evolution of the Complex of Local Interstellar Clouds

Diana Khimey (Undergraduate, Harvard; *now Master's student at ETH Zurich*) Winter 2020-Summer 2021
How Young Stars Leave Home

Shlomo Cahlon (Undergraduate, Harvard; *now software engineer at Microsoft*) Fall 2020-Summer 2022

A Uniform Catalog of Local Molecular Clouds Based on 3D Dust Mapping

Alan Tu (Undergraduate, Harvard) Summer 2020–Spring 2022
Characterizing the 3D Motion of a Galactic-scale Gas Wave

Kaustav Das (Undergraduate, IIT Kanpur; *now PhD student at Caltech*) Summer 2019–Fall 2020
Constraining the Distance to the North Polar Spur with *Gaia* DR2

Laura Chapman (Undergraduate, Harvard; *now software engineer at Google*) Summer 2018
A Statistical Plugin for the *glue* Visualization Environment

PRESENTATIONS

I have given **59 talks**, including **38 invited** colloquia, seminars, and conference talks. Highlights include:

Colloquia:

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
Max Planck Institute for Astronomy	May 2021
University of Texas at Austin	April 2021
University of Wisconsin-Madison	September 2020
Harvard Institute for Theory & Computation	September 2020
American Museum of Natural History	December 2019
Smithsonian Astrophysical Observatory	June 2019

Recent Invited Seminars (Selected):

University of Pennsylvania Astronomy Seminar	February 2023
NYU Center for Cosmology and Particle Physics	November 2022
Berlin Institute of Technology	May 2022

Recent Invited Conference Talks (Selected)

Self-Organization Across Scales (MIAPbP)	September 2022
IAU 373: Resolving the Rise & Fall of Star Formation in Galaxies	August 2022
52nd AAS Division on Dynamical Astronomy Meeting	May 2021

SELECTED PROFESSIONAL ACTIVITIES

Guest Editor, Annual Review of Astronomy & Astrophysics (ARAA, Volume 63)	Spring 2023
SOC, Mapping the Milky Way at the Lorentz Center	Winter 2022
Organizer, Low Density Universe Meetings at STScI/JHU	Fall 2022 – Present
NASA Astrophysics Data Analysis Program (ADAP) Panel Reviewer	Summer 2022
SDSS-V Dust Program Working Group Co-Chair	Summer 2022–Present
Head of the SOC, *Seeing the Future* Conference	Spring 2022
Interdisciplinary conference at the intersection of astronomy/data/education/digital scholarship	
AAS WorldWide Telescope Software Steering Committee	Fall 2021 – Present
Referee for ApJ, A&A, AJ, & MNRAS	Fall 2018 – Present
NSF Astronomy & Astrophysics Research Grants (AAG) Panel Reviewer	Spring 2021
Harvard Data Science Review, Emerging Scholars Board	Spring 2020–Fall 2022
SOC, Harvard-Heidelberg Meeting on Star Formation	Fall 2017, Fall 2019
Harvard Star Formation Journal Club Series Co-Organizer	Spring 2018–Spring 2020
Core member, glue visualization software team	Spring 2017–Present

SELECTED OUTREACH & MENTORING

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
Public Talk, Southern Maine Astronomers — Summer 2021
Public Talk, Gloucester Area Astronomy Club — Summer 2019
Astronomy Rewind, Volunteer Lead — Fall 2018
Public Talk, New Hampshire Astronomical Society — Spring 2018
Cambridge Explores the Universe Volunteer — Spring 2016, 2017, 2018, 2019
Dark Skies, Bright Kids Planetarium Lead — Spring 2012 – Summer 2015

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