

# CATHERINE ZUCKER

Hubble Fellow, Space Telescope Science Institute

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## RESEARCH INTERESTS

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

## RESEARCH POSITIONS

Hubble Fellow: Space Telescope Science Institute

Fall 2021–Present

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

NASA Hubble Fellowship Program Hubble Fellowship

Fall 2021

Protostars & Planets VII (PPVII) Chapter Lead

Fall 2020

Competitively selected to lead review chapter/talk at the upcoming 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 34 publications with > 1000 citations. See [ADS](#) for a full list. Highlights include:

12 papers as first author/co–PI (> 400 citations), including 1 *Nature* publication and 1 review paper

10 papers as second or third author, including 1 *Nature* publication

2 papers led by undergraduate students, for which I served as a primary science advisor (denoted by \*)

### 1<sup>st</sup> author/co–PI:

1. Zucker, C., Peek, J., and Loebman, S., 2022. *ApJ Letters*, Submitted. Disconnecting the Dots: Re–examining the Nature of Stellar “Strings” in the Milky Way.
2. Zucker, C., Alves, J., Goodman, A., and Meingast, S., Galli, P. 2022. *Protostars and Planets Volume VII*, Under Review. The Solar Neighborhood in the Age of Gaia.
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. \*Tu, A., Zucker, C., Speagle, J., Beane, A., Goodman, A., Alves, J., Faherty, J., and Burkert, A. 2022, *ApJ*, Submitted. [Characterizing the 3D Kinematics of Young Stars in the Radcliffe Wave](#).
14. Stephens, I., Myers, P., Zucker, C. [21 co-authors]. 2022. *ApJL*, 96, 6. [The Magnetic Field in the Milky Way Filamentary Bone G47](#).
15. 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](#).
16. 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](#).
17. Speagle, J., Zucker, C. [17 authors]. 2021. *ApJ*, Submitted. [Mapping the Milky Way in 5-D with 170 Million Stars at High Galactic Latitudes](#).
18. Speagle, J., Zucker, C. [17 authors]. 2021, *ApJ*, Submitted. [Deriving Stellar Properties, Distances, and Reddenings from Photometry and Astrometry with brutus](#).
19. \*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](#).
20. 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](#).
21. Green, G., Schlafly, E., Zucker, C., Speagle, J., Finkbeiner, D. 2019. *MNRAS*, 487, 93. [A 3D Dust Map Based on Gaia, Pan-STARRS 1 and 2MASS](#).
22. 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:

23. 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*, Submitted. [The Radcliffe Wave as the Gas Spine of the Orion Arm](#).
24. 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](#).
25. 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 p Oph region revisited with Gaia EDR3: Two young populations, new members, and old impostors](#).
26. 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](#).
27. 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](#).

28. 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](#).
29. 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](#).
30. 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](#).
31. 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](#).
32. 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](#).
33. 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>](#).
34. 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

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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

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I have served as a primary science advisor for six students:

Elijah Mullens (University of Florida, Postgraduate)

Spring 2022–Present

Unveiling the Nature of Diffuse Interstellar Envelopes around Nearby Dense Clouds

Diana Khimey (Harvard University, Undergraduate)

Winter 2020–Summer 2021

How Young Stars Leave Home

Shlomo Cahlon (Harvard University, Undergraduate)

Fall 2020–Summer 2022

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

Alan Tu (Harvard University, Undergraduate)

Summer 2020–Spring 2022

Characterizing the 3D Motion of a Galactic-scale Gas Wave

Kaustav Das (IIT Kanpur, Undergraduate)

Summer 2019–Fall 2020

Constraining the Distance to the North Polar Spur with *Gaia* DR2

Laura Chapman (Harvard University, Undergraduate)

Summer 2018

A Statistical Plugin for the *glue* Visualization Environment

## PRESENTATIONS

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I have given **44 talks**, including **26 invited** colloquia, seminars, and conference talks. Recent highlights include:

### Colloquia:

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):**

Berlin Institute of Technology	May 2022
Japan Star & Planet Formation Seminar	April 2022
University of Maryland CTC Lunch Talk	March 2022
Caltech Tea Talk	February 2022
ESA Science Seminar	January 2022

**Recent Invited Conference Talks (Selected)**

52 <sup>nd</sup> AAS Division on Dynamical Astronomy Meeting	May 2021
236 <sup>th</sup> Meeting-in-Meeting (ISM in the Era of Big Data)	June 2020

**SELECTED PROFESSIONAL ACTIVITIES**

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
SDSS-V Dust Program Team	Fall 2020–Present
Harvard Data Science Review, Emerging Scholars Board	Spring 2020–Present
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 & PUBLIC TALKS**

WorldWide Telescope Ambassador	Fall 2015 – Present
Subject Matter Expert, NASA Cosmic Data Stories	Fall 2020 – Present
Public understanding of data science via interactive research stories	
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**

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