Catherine Zucker

Center for Astrophysics | Harvard & Smithsonian

catherine.zucker@cfa.harvard.edu

Last Updated: April 2020

EDUCATION

Harvard University: PhD in Astronomy & Astrophysics — 2017 - 2020
Dissertation: *Charting our Uncharted Milky Way*
Advisors: Alyssa Goodman & Douglas Finkbeiner

Harvard University: M.A. in Astronomy and Astrophysics — 2015 - 2017

University of Virginia: B.A. in Astronomy-Physics and B.A. in History — 2011 - 2015

RESEARCH INTERESTS

My research focuses on developing novel techniques to tease out the true 3D structure of our Galaxy. I use a combination of observations, simulations, astrostatistics, and data visualization to gain new insight into the nature and structure of our Milky Way's interstellar medium. Some of my research highlights include:

- Producing the largest and most accurate map of stellar nurseries in our solar neighborhood
- The discovery of the *Radcliffe Wave*, a 2.7 kpc long sinuosoidal structure which redefines the shape of the Local Arm in our Galaxy. Press.
- Knitting together gas and dust observations to produce high-resolution 4D views of nearby molecular clouds
- Characterizing the physical properties of the largest-scale filaments in the interstellar medium of our Galaxy via observations and simulations
- *Big Data*, bayesian statistics, statistical computing, and interactive data visualization

PUBLICATIONS

I have co-authored 16 publications, including eight as (co-) first author. A full listing of my publications can be found on ADS.

First Author/co-PI

1. **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.
2. **Zucker, C**; Smith, R.; Goodman, A. 2019. *ApJ*, 887, 186. Synthetic Large-Scale Galactic Filaments — on their Formation, Physical Properties, and Resemblance to Observations.
3. **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
4. **Zucker, C**; Schlafly, E.; Green, G.; Speagle, J.; Portillo, S.; Finkbeiner, D.; Goodman, A. 2018c. *ApJ*, 869, 83. Mapping Distances across the Perseus Molecular Cloud Using CO Observations, Stellar Photometry, and Gaia DR2 Parallax Measurements.
5. **Zucker, C** & Chen, H. H. 2018b. *ApJ*, 864, 162. RadFil: A Python Package for Building and Fitting Radial Profiles for Interstellar Filaments.
6. **Zucker, C**; Battersby, C.; Goodman, A. 2018a. *ApJ*, 864, 2. The Physical Properties of Large-scale Galactic Filaments.

7. **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.
8. **Zucker, C**; Battersby, C.; Goodman, A. 2015. *ApJ*, 815, 23. The Skeleton of the Milky Way.

Contributing Author

1. 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*. Submitted. Dense Gas in a Giant Molecular Filament
2. Alves, J., **Zucker, C.**, Goodman, A., Speagle, J., Meingast, S., Robitaille, T., Finkbeiner, D., Schlafly, E., Green, G. 2020. *Nature*. A Galactic-scale gas wave in the Solar Neighborhood.
3. Smith, R. J., Tress, R., Sormani, C., Clover, S. Klessen, R., Clark, P., Izquierdo, A., Duarte-Cabral, A., **Zucker, C.**. 2019. *MNRAS*. Accepted. The Cloud Factory I: Generating resolved filamentary molecular clouds from galactic-scale forces
4. 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.
5. 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.
6. 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_3.
7. 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
8. 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

Unrefereed

1. Invited *Perspective* article for the February 2020 issue of the Star Formation Newsletter (distributed to $>$ 1000 star formation researchers in 34 countries). *Distances to Star-Forming Regions.*

PRESENTATIONS

I have given a total of 23 talks, including 7 invited talks.

Talks

1. Lunch Seminar, Harvard Astrostatistics Group (Harvard University)	March 2020
2. Lunch Seminar, University of Washington (Seattle, Washington)	February 2020
3. Contributed Talk, NE Regional Star Formation Meeting (U. Conn.)	January 2020
4. Invited Colloquium, AMNH (New York, New York)	December 2019
5. Contributed Talk, Harvard-Heidelberg Meeting on Star Formation (Cambridge, MA)	November 2019
6. Invited Talk, The self-organized star formation process (Orsay, France)	October 2019

7. Contributed Talk, Crete III – Through dark lanes to new stars (Heraklion, Crete) September 2019
8. Invited Colloquium, SAO REU Summer Colloquium Series (Harvard CfA) June 2019
9. Contributed Talk, New England Regional SF Meeting (UMass) Januay 2019
10. Contributed Talk, Harvard Heidelberg Meeting on Star Formation (MPIA) December 2018
11. Invited Talk, ITC Luncheon (Harvard CfA) November 2018
12. Contributed Talk, Interstellar Filament Paradigm (Nagoya, Japan) November 2018
13. Invited Talk, The Milky Way in the Age of Gaia (Orsay, France) October 2018
14. Invited Talk, MIT Haystack August, 2018
15. Contributed Talk, the Olympian Symposium (Paralia, Greece) May 2018
16. Contributed Talk, AAS Splinter Session (Washington, DC) January 2018
17. Contributed Talk, Sun, Stars, and Galaxies (U. Manchester, UK) October 2017
18. Contributed Talk, Harvard Astrostats Day (Harvard CfA) September 2017
19. Contributed Talk, Galactic Star Formation with Survey (MPIA) July 2017
20. Invited Talk, Dunlap Institute (Toronto, Canada) May 2017
21. Contributed Talk, New England Region SF Meeting January 2016
22. Contributed Talk, Filamentary Structure in Molecular Clouds (Charlottesville, VA) October 2014
23. Talk, SAO Astronomy Intern Symposium (Harvard CfA) August 2014

SELECTED AWARDS

- Harvard-Horizons 2020 Scholar — Spring 2020
  Top eight graduate students selected across Harvard to receive professional development training, culminating in public "TED-style" talk
- Certificate of Distinction in Teaching, Harvard University — Spring 2019
- Harvard Astronomy Departmental Teaching Award — Spring 2018
- Certificate of Distinction in Teaching, Harvard University — Spring 2018
- La Serena School for Data Science Full Scholarship — Summer 2017
- NSF Graduate Research Fellowship Award — Fall 2016-Spring 2020
  Supports outstanding graduate students in NSF-supported science disciplines
- John P. and Carol J. Merrill Graduate Fellowship, Harvard University — Fall 2015-Spring 2017
- Peirce Fellowship, Harvard Astronomy — Fall 2015-Fall 2018
  Internal fellowship for top three admitted Harvard Astronomy applicants
- UVA Undergraduate Physics Research Symposium, 1st Place — Fall 2014
- Vyssotsky Prize, University of Virginia Astronomy — Spring 2014
  Awarded to one outstanding third year astrophysics major at the University of Virginia
- Double Hoo Research Award, University of Virginia — Spring 2014
- Intermediate Honors, University of Virginia — Fall 2013
- Virginia Space Grant Consortium Research Fellowship — Summer 2013–Spring 2014
- Kate Cabell Claiborne Cox Scholarship, University of Virginia History — Spring 2013
- Harrison Undergraduate Research Award, University of Virginia — Summer 2013–Spring 2014
- Echols Scholarship Fund Grant, University of Virginia — Summer 2012

- Small Research and Travel Grant, University of Virginia — Summer 2012
- Wolfe Undergraduate Docent Award, University of Virginia — Spring 2012
- Echols Scholar, University of Virginia — Fall 2011–Fall 2015

TEACHING & MENTORING

Teaching

I have served as a teaching fellow for both an undergraduate and graduate course. Both times, I received the Bok Center Certificate of Distinction in Teaching, based on high evaluations in student course feedback. I also received the Harvard Astronomy departmental award for teaching excellence in Spring 2018.

- Physics & Chemistry of the ISM (AY203). Harvard University. — Spring 2019
- Galactic and Extragalactic Astronomy (AY17). Harvard University. — Fall 2017

Mentoring

- Kaustav Das (IIT Kanpur). Undergraduate Research. — Summer 2019 - Present
  Constraining the Distance to the North Polar Spur with Gaia DR2
- Laura Chapman (Harvard University). Undergraduate Research. — Summer 2018
  A statistics plugin for the glue visualization environment

PROFESSIONAL ACTIVITIES

- Harvard Data Science Review, Student Editorial Board — Spring 2020 - Present
- Scientific Organizing Committee, Harvard-Heidelberg Star Formation Meeting 2019 — Fall 2019
- Referee for *A&A*, *AJ*, and *MNRAS* — Fall 2018 - Present
- Core member, `glue` visualization software team — Spring 2017 - Present
- CfA Star Formation Journal Club Series Co-Organizer — Spring 2018 - Present
- American Astronomical Society, Junior Member — Fall 2015 - Present

PRESS

For full overview of *Radcliffe Wave* press coverage, see our website. Total of 324 news stories, with selected highlights below.

- Appeared live on NPR's Science Friday (with A. Goodman) discussing the *Radcliffe Wave* — January 2020
- Harvard Gazette Interview on the discovery of the *Radcliffe Wave* — January 2020
- Interview with The Associated Press on the *Radcliffe Wave* — January 2020
- Interview with Sky & Telescope on the *Radcliffe Wave*
- Appeared on Dr. Becky podcast (with A. Goodman & J. Alves) on the *Radcliffe Wave* — January 2020
- Interview with Science News on the Milky Way Skeleton — December 2015
- Interview with Space.com on the Milky Way Skeleton — January 2015

OUTREACH

- 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, Harvard University — Spring 2016, 2017, 2018, 2019
- Development of the MilkyWay3D.com Galactic Plane Mapper Tool — Fall 2016
- Harvard College Undergraduate Research Association Conference Invited Speaker — Fall 2016
- *Dark Skies, Bright Kids Planetarium Lead*, University of Virginia — March 2012–May 2015
- Harrison Institute for American History Docent, University of Virginia — September 2011–May 2015

OBSERVING EXPERIENCE

Cerro Tololo Observatory, Chile (Blanco 4m) (2 half-nights)	July 2019
Cerro Tololo Observatory, Chile (Blanco 4m) (2 nights)	May 2019
Cerro Tololo Observatory, Chile (Blanco 4m) (2 half-nights)	January 2019
Cerro Tololo Observatory, Chile (Blanco 4m) (4 half-nights)	August 2018
Cerro Tololo Observatory, Chile (Blanco 4m) (3 nights)	February 2018
MMT Observatory; Tucson, AZ (4 nights)	August 2014
Kitt Peak Observatory (Bok 90”); Tucson, AZ (5 nights)	December 2012