

Elisabeth A.C. Mills | Assistant Professor

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Education

University of California, Los Angeles <i>Ph.D., Astronomy</i> Thesis: Extremes of Temperature and Density in Galactic Center Molecular Clouds Advisor: Mark R. Morris	Los Angeles, CA 2007–2013
Indiana University <i>Bachelors of Science , Physics & Astronomy</i>	Bloomington, IN 2002–2007

Primary Research Interests

The Galactic Center, the Molecular Interstellar Medium, Nearby Galaxies, Astrochemistry, Star Formation, Radio and Millimeter Astronomy

Appointments

San Jose State University <i>Assistant Professor</i> Teaching and supervising undergraduate and masters students	San Jose, CA 2016–present
Steward Observatory <i>Postdoctoral Researcher, Jansky Fellow</i> Leading radio and millimeter surveys of molecular gas in the Galactic center and nearby galaxies	Tucson, AZ 2015–2016
National Radio Astronomy Observatory <i>Postdoctoral Researcher, Jansky Fellow</i> Lead radio surveys of molecular gas physical conditions and chemistry in the Galactic center	Socorro, NM 2013–2015
University of California, Los Angeles <i>Graduate Researcher, NSF GK-12 Fellow</i> Conducted radio, submillimeter, and infrared surveys of the ISM. Provided new constraints on gas temperatures and densities in the Galactic Center	Los Angeles, CA 2007–2013
National Radio Astronomy Observatory <i>Undergraduate Researcher, REU Student</i> Studied the dust continuum from Galactic Center molecular clouds	Socorro, NM Summer 2006
Indiana University <i>Undergraduate Researcher, IU STARS Scholar</i> Determined HI rotation curves for a sample of nearby dwarf galaxies	Bloomington, IN 2006
National Optical Astronomy Observatory <i>Undergraduate Researcher, REU Student</i> Measured intervening extinction toward a sample of planetary nebulae	La Serena, Chile Winter 2005
Indiana University <i>Undergraduate Researcher, IU STARS Scholar</i>	Bloomington, IN 2002–2005

Performed optical photometry yielding constraints on open star cluster parameters

Short-term Positions

Max Planck Institute for Astronomy <i>Visiting Scientist, Summer Visitor Program</i>	Heidelberg, Germany <i>Summer 2016</i>
European Southern Observatory <i>Visiting Scientist, Scientific Visitor Programme</i>	Garching, Germany <i>May 2015</i>
Max Planck Institute for Astronomy <i>Visiting Researcher, Planet & Star Formation department</i>	Heidelberg, Germany <i>2012-2013</i>
National Radio Astronomy Observatory <i>Visiting Researcher, NRAO Resident Shared-Risk Observing Program</i>	Socorro, NM <i>Summer 2012</i>

Grants and Awards

- 2015:** ALMA Development Grant Co-I (\$185,000)
- 2013:** Jansky Postdoctoral Fellowship (\$225,000)
- 2013:** NSF Astronomy and Astrophysics Postdoctoral Fellowship, declined (\$267,000)
- 2013:** NRAO Student Observing Support Program (\$10,000)
- 2010:** NSF GK-12 Fellowship (\$30,000 + fees)
- 2010:** NRAO Student Observing Support Program (\$35,000)
- 2008:** Chancellor's Prize Graduate Summer Research Mentorship Award (\$5000)
- 2007:** Chancellor's Prize (\$5000)
- 2005:** Sigma Xi Grant-in-Aid of Research Award (\$500)

Honors

- 2013:** AAS Doxsey Prize
- 2008:** Honorable mention, NSF Graduate Research Fellowship
- 2007:** Honorable mention, NSF Graduate Research Fellowship
- 2007:** Outstanding Undergraduate Physics Major, IU Physics Dept.
- 2007:** Honorable Mention, AAS Chambliss Award
- 2006:** Johnson Award for Excellence in Student Research, IU Astronomy Dept.
- 2006:** Alumni Award for Overall Academic Excellence, IU Astronomy Dept.
- 2005:** Elected to Phi Beta Kappa
- 2002-2007:** Indiana University Science, Technology, and Research Scholar

Students

2016-2017:

- **J. Andrew Casey-Clyde** *San Jose State University:*
First year Masters student

Summer 2015:

- **Kevin Gima** *(Prince George Community College):*
Currently a Senior Astronomy major at the University of Maryland

- **Tierra Candelaria** (*College of Idaho*):
Currently a second-year Astronomy PhD student at New Mexico Institute of Mining and Technology

Summer 2014:

- **Jonathan Barnes** (*Norfolk State University*): How Dense are Galactic Center Clouds?
Currently a second-year Astronomy Masters student at CSU Los Angeles
- **Aspen Clements** (*University of Nebraska-Kearney*): Deuterated Ammonia in Sgr B2
Currently a second-year Chemistry PhD student at the University of Virginia
- **Binqing "Iris" Sun** (*Nanjing University*): Measuring the Temperature of the Circumnuclear Disk
Currently a first-year Astronomy PhD student at UMass
- **Alex Teachey** (*Hunter College*): Characterizing Ammonia Masers in the Galactic Center
Currently a first-year Astronomy PhD student and NSF graduate research fellow at Columbia University

Selected Accepted Observing Proposals

Date	Facility	Time	Status
2015	VLA	2 hrs	DDT search for new Galactic center OH masers (PI)
2015	ALMA	4.7 hrs	Dating the accretion flow around our supermassive black hole
2015	ALMA	28.6 hrs	Surveying the core of the NGC 253 Starburst at 1 pc resolution
2015	ALMA	2.1 hrs	Proper motion of gas around our supermassive black hole
2014	ALMA	16.4 hrs	Excitation study of the Galactic center Circumnuclear Disk (PI)
2014	ALMA	5.9 hrs	Study of atomic gas accretion onto our supermassive black hole
2014	ALMA	7.6 hrs	Search for neutral gas within 0.1 pc of our supermassive black hole
2014	ALMA	2.9 hrs	Studying Galactic center absorption filaments
2014	ALMA	22 hrs	Probing the star formation potential in Sgr B2
2014	GBT	74.5 hrs	Survey of Highly-Excited Ammonia in Nearby Galaxies (PI)
2014	ATCA	3 weeks	Large molecular lines survey of the GC (Co-PI with J. Ott, D. Meier)
2013	VLA	9 hrs	Constraints on dense gas in Galactic center clouds (PI)
2012	VLA	1.5 hrs	DDT search for star formation in a GC cloud (PI) , published in ApJ
2011	VLA	24 hrs	Survey of molecular lines in Galactic center clouds (PI) , published in ApJ
2010	GBT	9 hrs	Survey of hot ammonia in the Galactic center (PI) , published in ApJ

Teaching Experience

Spring 2017: Introduction to Astronomy and Astrophysics II

- Taught one section of a non-majors introduction to astronomy course
- Taught one section of an introductory astronomy course on the ISM and stellar interiors for Physics majors

Fall 2016: Introduction to Astronomy

- Taught two sections of a non-major introduction to astronomy course

Summer 2015: National Astronomy Consortium Cohort Leader

- Developed curriculum and led 1 hr weekly professional development seminar

Summer 2015: Galactic Center Group Meeting Leader

- Led a weekly 1 hr research seminar covering star formation, molecular gas, the Milky Way, and nearby galaxies

2010–2011: NSF GK-12 Fellow at Culver City Middle School, Culver City, CA

- Taught in the classroom two days a week with a local teacher
- Created new lesson materials to enhanced the classroom science curriculum

2008–2010: Teaching Assistant, University of California, Los Angeles

- Astrophysics II: Stellar Evolution, Galaxies, and Cosmology Spring 2010
- Life in Universe Summer 2009
- Cosmology: Our Changing Concepts of the Universe Spring 2009
- Nature of Universe lab Spring 2009
- Stellar Atmospheres, Interiors, and Evolution Winter 2008

2007–2009: Center for Adaptive Optics Professional Development Program

- Workshops:
 - Re-Thinking Science & Engineering Learning & Teaching (Santa Cruz, CA) November 2007
 - Inquiry in Science & Engineering Learning & Teaching (Maui, HI) March 2008
 - Advancing Inquiry & the PDP Community (Santa Cruz, CA) April 2009
 - Inquiry in Science & Engineering Learning & Teaching (Maui, HI) May 2009
- Teaching:
 - *Po'okela program for Native Hawaiian high school students* (Maui, HI) July 2008
Developed and taught a week-long program of inquiry-based astronomy to encourage students to pursue science & technical careers in Hawaii.
 - *Akamai Internship program for Hawaiian college students* (Big Island, HI) June 2009
Led a team to develop & co-teach a week-long program of inquiry-based astronomy to prepare students for a 10-week internship at the Mauna Kea Observatories.

Colloquia and Invited Talks

08/2017: Invited Review, "Star Formation in Different Environments", Quy Nhon, Viet Nam

05/2017: Santa Clara College Colloquium

05/2017: California State University-Northridge Colloquium

04/2017: JPL Lunch seminar

04/2017: California State University-East Bay Colloquium

02/2017: SOFIA Colloquium, NASA-Ames

10/2016: San Francisco State Colloquium

07/2016: Invited Review, "IAU 322: The Multi-Messenger Astrophysics of the Galactic Centre", Palm Cove, Australia

07/2016: Königstuhl Colloquium, Max Planck Institute for Astronomy, Heidelberg, Germany

04/2016: New Mexico State Colloquium

03/2016: Invited Review, "Carnegie Radio Showcase", Pasadena, CA

03/2016: San Jose State Colloquium

03/016: Herzberg Institute of Astrophysics Colloquium

03/2016: University of British Columbia Colloquium

- 01/2016:** Northwestern CIERA Theory Seminar
- 10/2015:** Invited Review, "Bashfest ", University of Texas at Austin
- 05/2015:** Max Planck Institute for Radio Astronomy Special Colloquium
- 05/2015:** Invited ALMA Community Day Talk, Tucson,AZ
- 03/2015:** Invited Review, "The Soul of High Mass Star Formation" Puerto Varas, Chile
- 02/2015:** National Radio Astronomy Observatory-Socorro Colloquium
- 12/2014:** National Radio Astronomy Observatory-Green Bank Colloquium
- 07/2014:** Los Alamos National Laboratory Astrophysics Colloquium
- 03/2014:** Joint University of Virginia / National Radio Astronomy Observatory Colloquium
- 02/2014:** University of New Mexico Astrophysics Colloquium

Additional Talks

Conference Talks.....

- 01/2017:** "Star Formation and Nearby Galaxies with JWST", Pasadena, CA
- 07/2016:** "IAU 322: The Multi-Messenger Astrophysics of the Galactic Centre", Palm Cove, Australia
- 02/2016:** "Dynamics and accretion at the Galactic Center", Aspen, CO
- 12/2015:** US Radio Futures Meeting, Chicago, IL
- 03/2015:** Tools for Astronomical Big Data, Tucson, AZ
- 07/2014:** Behind the curtain of Dust: The molecular view of activity in (U)LIRGS, Sesto, Italy
- 01/2014:** Science with the Atacama Pathfinder Experiment (APEX), Ringberg Castle, Germany
- 01/2014:** 223rd Meeting of the American Astronomical Society, Washington, DC
- 10/2013:** IAU 303 The Galactic Center: Feeding and Feedback in a Normal Galactic Nucleus, Santa Fe, NM
- 06/2013:** Regulation of Star Formation in Molecular Gas, Ringberg Castle, Germany
- 01/2013:** 221st Meeting of the American Astronomical Society, Long Beach, CA
- 06/2012:** 220th Meeting of the American Astronomical Society, Anchorage, AK
- 12/2010:** Star Formation Under Extreme Conditions: the Galactic Center, Besançon, France

Visitor Seminars.....

- 06/2016:** Guest Seminar, University of Manchester, England
- 06/2016:** Guest Seminar, Universitat Köln, Germany
- 10/2015:** NOAO FLASH seminar Tucson, AZ
- 05/2015:** ESO Wine and Cheese talk, Garching, Germany
- 09/2014:** Origins Seminar, Tucson, AZ
- 02/2014:** Visitor Talk at Max Planck Institute for Astronomy, Heidelberg, Germany
- 01/2014:** ESO Lunch Talk, Garching, Germany

01/2014: Lunch Talk, National Radio Astronomy Observatory, Socorro, NM

01/2013: Guest Seminar, Leiden, The Netherlands

12/2012: Guest Seminar, ETH Institute For Astronomy, Zurich, Switzerland

11/2012: Planet & Star Formation Seminar, MPIA, Heidelberg, Germany

07/2012: Lunch Talk, National Radio Astronomy Observatory, Socorro, NM

03/2011: Lunch Talk, National Radio Astronomy Observatory, Socorro, NM

Blackboard Talks.....

04/2015: ESO Informal Discussion, Garching, Germany

09/2014: NOAO Coffee discussion, Tucson, AZ

Public Talks.....

04/2014: NRAO Visitors Committee, Socorro, NM

Service

Grant review panelist for NSF AAG program:

2013–Present Papers Refereed (MNRAS, ApJ, ApJL, A&A)

Outreach

2014–2015: Led public VLA tours

2013: Writer for Astrobites

- Author of blog posts to summarize recent papers for a target audience of Undergraduate students

2010–2011: UCLA Astronomy Outreach Co-Coordinator

2009–2012: UCLA Astronomy Outreach Volunteer

- Founding volunteer of an annual UCLA Astronomy Open House for hands-on science experience
- Developed and built new outreach activities for use at open houses and schools, including an interactive star wall
- Led more than 10 volunteer events on campus and at local underserved schools
- Presented over 20 planetarium shows to diverse audiences

Publications

Refereed Publications.....

18. Mills, E.A.C. and Battersby, C *Origins of Scatter in the Relationship Between HCN 1-0 and Dense Gas Mass in the Galactic Center* ApJ Accepted

17. Liu, H.B., Wright, M.C.H., Zhao, J.H., Brinkerink, C.D., Ho, P.T. P., Mills, E.A.C., Martin, S., Falcke, H., Matsushita, S., Martí-Vidal, I. *Linearly Polarized Millimeter and Submillimeter Continuum Emission of Sgr A* Constrained by ALMA* A&A Accepted

16. Liu, H.B., Wright, M.C.H., Zhao, J.H., Mills, E.A.C., Requena-Torres, M.A., Matsushita, S., Martin, S. *The 492 GHz emission of Sgr A* constrained by ALMA* A&A Accepted

15. Feng, S., Beuther, H., Semenov, D., Henning, T., Linz, H., Mills, E.A.C. *Inferring the Evolutionary Stages of NGC 7538 S and NGC 7538 IRS1 from Chemistry.*

A&A Accepted.

14. Ludovici, D.A., Lang, C.C., Morris, M.R., Mutel, R., **Mills, E.A.C.**, Toomey, J.E. *The Unusual Galactic Center Radio Source N3* 2016 ApJ 826:218-237

13. Henshaw, J.D., Longmore, S.N., Kruijssen, J.M.D., Battersby, C., Moore, T.J.T., Burton, M., Ott, J., Dale, J., Pillai, T., Ginsburg, A., Schmiedeke, A., Davies, B., Kendrew, S., **Mills, E.A.C.**, Walker, D., Barnes, A., Immer, K., Zhang, Q. *Molecular gas kinematics within the central 250 pc of the Milky Way* 2016 MNRAS, 457:2675-2702

12. Lau, R.M., Hankins, M.J., Herter, T.L., Morris, M.R., **Mills, E.A.C.** *A Dusty Helical Outflow from an Interacting Massive and Evolved Binary* 2016 ApJ, 818:117-130

11. Ginsburg, A., Ao, Y., Riquelme, D., Kauffmann, J., Pillai, T., **Mills, E.A.C.**, Requena-Torres, M.A., Immer, K., Testi, L., Ott, J., Bally, J., Battersby, C., Darling, J., Aalto, S., Stanke, T., Kendrew, S., Kruijssen, J.M.D., Longmore, S., Dale, J., Guesten, R., Menten, K.M. *Dense gas in the Galactic central molecular zone is warm and heated by turbulence* 2016 A&A, 586:50-81

10. Ginsburg, A., Walsh, A., Henkel, C., Jones, P.A., Cunningham, M., Kauffmann, J., Pillai, T., **Mills, E.A.C.**, Ott, J., Kruijssen, J.M.D., Menten, K.M., Battersby, C., Rathborne, J., Contreras, Y., Longmore, S., Walker, D., Dawson, J. *High-mass star-forming cloud G0.38+0.04 in the Galactic Center Dust Ridge contains H₂CO and SiO masers* 2016 A&A, 584:7-12

9. Feng, S., Beuther, H., Henning, T., Semenov, D., Palau, A., **Mills, E.A.C.** *Resolving the Chemical Substructure of Orion-KL*. 2015, A&A, 581:71-121

8. **Mills, E.A.C.**, Lang, C.C., Butterfield, N., Ludovici, D.A., Schmitz, S., Ott, J., Morris, M.R. *Abundant CH₃OH Masers but no New Evidence for Star Formation in GCM0.253+0.016*. 2015, ApJ, 805:72-97

7. **Mills, E.A.C.**, Güsten, R., Requena-Torres, M.A., Morris, M.R. *The Excitation of HCN and HCO⁺ in the Galactic Center Circumnuclear Disk*. 2013, ApJ, 779:47-67

6. **Mills, E.A.C.**, Morris, M.R. *Detection of Widespread Hot Ammonia in the Galactic Center*. 2013, ApJ, 772:105-124

5. **Mills, E.A.**, Morris, M.R., Lang, C.C., Cotera, A., Dong, H., Wang, Q.D., Stolovy, S. *Properties of the Compact H II Regions G-0.02-0.07*. 2011, ApJ, 735:84-96

4. Dong, H., Wang, Q.D., Cotera, A., Stolovy, S., Morris, M.R., Mauerhan, J., **Mills, E.A.**, Schneider, G., Calzetti, D., Lang, C.C. *Hubble Space Telescope Paschen α survey of the Galactic Centre: data reduction and products*. 2011, MNRAS, 417:114-135

3. Stolte, A., Ghez, A.M., Morris, M.R., Do, T., Ballard, C., **Mills, E.A.**, Lu, J.R., Matthews, K. *L-band sources in the Arches cluster*. 2010, ApJ, 718:810-831

2. Bally, J., Aguirre, J., Battersby, C., Bradley, E.T., Cyganowski, C., Dowell, D., Drosback, M., Dunham, M.K., Evans, N.J. II, Ginsburg, A., Glenn, J., Harvey, P., **Mills, E.**, Merello, M., Rosolowsky, E., Shirley, Y.L., Schlingman, W., Stringfellow, G., Walawender, J., Williams, J. *The Bolocam Galactic Plane Survey: Dust Continuum Emission in the Galactic Center Region*. 2010, ApJ, 721:137-163

1. Beers, T.C., Flynn, C., Rossi, S., Sommer-Larsen, J., Wilhelm, R., Marsteller, B., Lee, Y.S., De Lee, N., Krugler, J., Deliyannis, C.P., Simmons, A.T., **Mills, E.**, Zickgraf, F.J., Holmberg, J., Ěnehag, A., Eriksson, A., Terndrup, D., Salim, S., Andersen, J., Nordström, B., Christlieb, N., Frebel, A., Rhee, J. *Broadband UBVRCIC Photometry of Horizontal-Branch and Metal-poor Candidates from the HK and Hamburg/ESO Surveys. I*. 2007, ApJS, 168:128-139

Proceedings and Other Works.....

8. Leroy, A.K., Murphy, E., Armus, L., Brogan, C., Donovan Meyer, J., Evans, A., Hunter, T., Johnson, K., Koda, J., Meier, D.S., Menten, K.M., **Mills, E.A.C.**, Momjian, E., Ott, J., Owen, F., Reid, M., Rosolowsky, E., Schinnerer, E., Scoville, N., Spekkens, K., van Zee, L., Wong, T. *Next Generation Very Large Array Memo No.*

7 Science Working Group 2: "Galaxy Ecosystems": The Matter Cycle in and Around Galaxies 2015

7. Mills, E.A.C., Ginsburg, A., Kruijssen, J.M.D., Sjouwerman, L., Lang, C.C., Mao, S.A., Walsh, A., Su, M., Longmore, S.N., Zhao, J.-H., Meier, D.M., Morris, M.R.

VLASSICK: The VLA Sky Survey in the Central Kiloparsec. 2014, A White paper for the VLA Sky Survey.

6. Mills, E.A.C., Lang, C.C., Morris, M.R., Ott, J., Butterfield, N., Ludovici, D., Schmitz, D., Schmeideke, A. *A Radio Survey of Galactic Center Clouds*. 2014, Proceedings of IAU 303:

"The Galactic Center: Feeding and Feedback in a Normal Galactic Nucleus"

5. Requena-Torres, M.A., **Mills, E.A.C.**, Güsten, R., , Morris, M.R., Weiss, A., Martín-Pintado, J., Harris, A. *Opening again the debate: the transient nature of the Circumnuclear Disk*. 2014, Proceedings of IAU 303: "The Galactic Center: Feeding and Feedback in a Normal Galactic Nucleus"

4. Sjouwerman, L. & **Mills, E.A.C.**

Galactic kU-band Thermal Survey (GUTS). 2013, A White paper for the VLA Sky Survey.

3. Mills, E.A., Morris, M.R., Lang, C.C., Cotera, A., Dong, H., Wang, Q.D., Stolovy, S.

Extinction toward the Compact HII Regions G-0.02-0.07. 2011, PASP, 439:125-127

2. Rafelski, M., Foley, M., Graves, G. J., Kretke, K. A., **Mills, E.**, Nassir, M., Patel, S.

Teaching Astronomy with an Inquiry Activity on Stellar Populations. 2010, PASP, 436, 108-119

1. Sonnet, S., **Mills, B.**, Hamilton, J.C., Kaluna, H. *The 2009 Akamai Observatory*

Short Course Inquiry Activity: "Design and Build a Telescope" 2010, PASP, 436, 131-137

Submitted and In Preparation

1. Mills, E.A.C., Togi, A., Kaufman, M. *"Hot Molecular Gas in the Circumnuclear Disk"* ApJ submitted.

2. Ginsburg, A., Goddi, C., Kruijssen, J. M.D., Bally, J., Smith, R., Galvan-Madrid, R., **Mills, E.A.C.**, Wang, K., Dale, J.E., Darling, J., Rosolowsky, E., Loughnane, R., Testi, L., Bastian, N., Pineda, J.E. *"Thermal Feedback in the High-mass Star and Cluster Forming Region W51: Massive Protostars Like Their Food Well-done"*. ApJ Submitted

3. Butterfield, N., Lang, C.C., Morris, M.R., Mills, E.A.C., Ott, J. *"GCM-0.20+0.033: An Expanding Molecular Shell in the Galactic Center Radio Arc"*. ApJ Submitted

4. Lu, X., Zhang, Q., Kauffmann, J., Pillai, T., Longmore, S.N., Kruijssen, J.M.D., Battersby, C., Liu, H.-B., Glisburg, A., **Mills, E.A.C.**, Zhang, Z. *"The Molecular Gas Environment in the 20 km/s Cloud in the Central Molecular Zone"*. ApJ Submitted.

5. Walker, D.L., Longmore, S.N., Zhang, Q., Battersby, C., Keto, E., Kruijssen, J.M.D., Ginsburg, A., Lu, X., Henshaw, J.D., Kauffmann, J., Pillai, T., **Mills, E.A.C.**, Walsh, A.J., Bally, J., Ho, L.C., Immer, K., Johnston, K.G. *"Star formation in a high-pressure environment: An SMA view of the Galactic centre dust ridge"*. MNRAS submitted.