Elisabeth A.C. Mills | Jansky Fellow

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Education

University of California, Los Angeles — **Los Angeles, CA**
Ph.D., Astronomy — *2007–2013*
Thesis: Extremes of Temperature and Density in Galactic Center Molecular Clouds
Advisor: Mark R. Morris

Indiana University — **Bloomington, IN**
Bachelors of Science , Physics & Astronomy — *2002–2007*

Primary Research Interests

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

Appointments

Steward Observatory — **Tucson, AZ**
Postdoctoral Researcher, Jansky Fellow — *2015–present*
Leading radio and millimeter surveys of molecular gas in the Galactic center and nearby galaxies

National Radio Astronomy Observatory — **Socorro, NM**
Postdoctoral Researcher, Jansky Fellow — *2013–2015*
Lead radio surveys of molecular gas physical conditions and chemistry in the Galactic center

University of California, Los Angeles — **Los Angeles, CA**
Graduate Researcher, NSF GK-12 Fellow — *2007–2013*
Conducted radio, submillimeter, and infrared surveys of the ISM.
Provided new constraints on gas temperatures and densities in the Galactic Center

National Radio Astronomy Observatory — **Socorro, NM**
Undergraduate Researcher, REU Student — *Summer 2006*
Studied the dust continuum from Galactic Center molecular clouds

Indiana University — **Bloomington, IN**
Undergraduate Researcher, IU STARS Scholar — *2006*
Determined HI rotation curves for a sample of nearby dwarf galaxies

National Optical Astronomy Observatory — **La Serena, Chile**
Undergraduate Researcher, REU Student — *Winter 2005*
Measured intervening extinction toward a sample of planetary nebulae

Indiana University — **Bloomington, IN**
Undergraduate Researcher, IU STARS Scholar — *2002–2005*
Performed optical photometry yielding constraints on open star cluster parameters

Grants and Awards

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 and Postdocs

Summer 2015:

- **Kevin Gima** *(Prince George Community College)*:
  Currently a Junior Astronomy major at the University of Maryland
- ***Tierra Candelaria*** *(College of Idaho)*:
  Currently a first-year Astronomy PhD student at New Mexico Institute of Mining and Technology
  Paper in prep.: "Measuring the Fraction of Superhot Molecular gas in the Galactic Center", Candelaria et. al.

Summer 2014:

- **Jonathan Barnes** *(Norfolk State University)*: How Dense are Galactic Center Clouds?
  Currently a first-year Astronomy Masters student at CSU Los Angeles
  Paper in prep.: "The Fraction of Dense Gas in the Central 300 pc of the Milky Way" Mills, Barnes et al.
- **Aspen Clements** *(University of Nebraska-Kearney)*: Deuterated Ammonia in Sgr B2
  Currently a first-year Chemistry PhD student at the University of Virginia
  Paper in prep.: "Warm Deuterated Ammonia in Sagittarius B2 (N)", Mills, Clements et al.
- **Binqing "Iris" Sun** *(Nanjing University)*: Measuring the Temperature of the Circumnuclear Disk
  Currently a student researcher at the National Astronomical Observatories of China
- **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
  Paper in prep.: "The Discovery of New Ammonia (3,3) Masers in the Galactic Center", Teachey et. al.

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

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

Spring 2016: Harvard-CfA Colloquium

Spring 2016: Herzberg Institute of Astrophysics Colloquium

Spring 2016: University of British Columbia Colloquium

10/2015: Bashfest Invited Review Speaker, 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

Selected Contributed Talks

012/2015: 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

Service

2014–Present: Led a student summer program at NRAO-Socorro for the National Astronomy Consortium

2014–Present: Advisory Board Member of the National Astronomy Consortium

2014–Present: Technical reviewer for NRAO proposals

2014–Present: AAS Chambliss Poster Judge

2013–Present: Papers Refereed (MNRAS, ApJ, ApJL)

2015: Grant review panelist for NSF AAG program

2015: Scientific Organizing Committee

- Next Generation VLA Meeting at the 215th AAS (Seattle, WA)
- Life-cycle of gas in galaxies: A local perspective (Dwingeloo, The Netherlands)

2015: ALMA Community Day Organizer (Tucson, AZ)

- Gave invited talks on research and an overview of NRAO facilities; assisted users with proposal preparation

2014–2015: Lunch Talk Coordinator, NRAO-Socorro

2014: 14th NRAO Synthesis Imaging Workshop (Socorro, NM)

- Led observing preparation and data reduction tutorials
- Created and ran a Careers & Diversity Panel

2012: NRAO Resident Shared-Risk Observing Program (3 months, Socorro, NM)

- Tested and documented new tools for VLA proposal preparation
- Redesigned the user interface for the CASA software webpage

05/2012: 13th NRAO Synthesis Imaging Workshop(Socorro, NM)

- Led observing preparation tutorials

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

11. 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 H_2CO and SiO masers* A&A Accepted

10. 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* A&A Accepted

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 CH_3OH 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.

5. 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"

4. 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"

6. 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

7. Mills, E.A.C., Ginsburg, A., ***Barnes, J.M.****, Wiesenfeld, L., Morris, M.R., Faure, A. *The Fraction of Dense Gas in the Central 300 pc of the Milky Way* In Preparation

6. Mills, E.A.C., ***Clements, A.****, Corby, J., Butterfield, N., Lang, C.C., Remijan, A.J., Cunningham, M., Jones, P., Ott, J., Morris, M.R. *Warm Deuterated Ammonia in Sagittarius B2 (N)* In Preparation

5. ***Teachey, A.****, **Mills, E.A.C.**, Ott, J., Meier, D., Minh, Y.C., Liu, H.B., Butterfield, N., Morris, M.R., Lang, C.C. *The Discovery of New Ammonia (3,3) Masers in the Galactic Center* In Preparation

4. Mills, E.A.C. *HCN 1-0 is not a Linear Tracer of Dense Gas Mass in the Galactic Center* Submitted to ApJ

3. 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* Submitted to MNRAS

2. 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* Submitted to ApJ

1. 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.
Submitted to A&A.

* ***Supervised Student***