Emily M. Silich

Department of Astronomy, California Institute of Technology
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Education

California Institute of Technology (Caltech)
Astrophysics, PhD (expected 2026) Astrophysics, MS (2023)

NSF Graduate Research Fellow	2023 - 2026
SAO Predoctoral Fellow	2024 - 2025
Wallace L. W. Sargent Graduate Fellow	2021 - 2022

Advisors: Sunil Golwala & Jack Sayers

University of Iowa
Astronomy, BS Physics, BS Mathematics, minor 2017 - 2021
with University Honors, High Distinction, Honors in Astronomy, Phi Beta Kappa

Research

Interests:

Galaxy clusters (584), Intracluster medium (858), X-ray astronomy (1810), Hydrodynamical simulations (767), Sunyaev-Zeldovich effect (1654), Circumgalactic medium (1897)

Experience:

Graduate Research Assistant 2021 - *pres.*
Division of Physics, Mathematics and Astronomy, Caltech

Predoctoral Fellow 2024 - 2025
Center for Astrophysics (CfA) | Harvard & Smithsonian

Undergraduate Research Assistant 2017 - 2021
Department of Physics & Astronomy, University of Iowa

Research Intern Summer 2020
X-ray Astrophysics Laboratory, NASA Goddard Space Flight Center

Student Researcher Winter 2019
Canada-Norway Student Sounding Rocket Program (CaNoRock)

Peer-reviewed publications

First-author works:

1. **E.M. Silich**, J. Sayers, P.F. Hopkins, et al., *"Exploring a Cosmic Ray Inverse-Compton Origin to the SZ-to-X-ray Pressure Deficit in the Cool Core Cluster ZwCl 3146"*, 2025, accepted for publication in The Astrophysical Journal.
2. **E.M. Silich**, J. ZuHone, E. Bellomi, et al., *"X-Ray Emission Signatures of Galactic Feedback in the Hot Circumgalactic Medium: Predictions from Cosmological Hydrodynamical Simulations"*, 2025, The Astrophysical Journal, 993, 125.
3. **E.M. Silich**, E. Bellomi, J. Sayers, et al., *"ICM-SHOX. Paper II: Galaxy Cluster Sample Overview"*, 2024, Proc. of the mm Universe 2023 conference, EPJ Web of conferences, EDP Sciences.
4. **E.M. Silich**, E. Bellomi, J. Sayers, et al., *"ICM-SHOX. Paper I: Methodology Overview and Discovery of a Gas–Dark Matter Velocity Decoupling in the MACS J0018.5+1626 Merger"*, 2024, The Astrophysical Journal, 968, 74.

5. **E.M. Silich**, K. Jahoda, L. Angelini, et al., *"A Search for the 3.5 keV Line from the Milky Way's Dark Matter Halo with HaloSat"*, 2021, The Astrophysical Journal, 916, 2.
6. **E.M. Silich**, P. Kaaret, A. Zajczyk, et al., *"Global X-Ray Properties of the Vela and Puppis A Supernova Remnants"*, 2020, The Astronomical Journal, 160, 1.

Co-author works

1. P.F. Hopkins, **E.M. Silich**, J. Sayers, et al., *"An Inverse-Compton-Boosted Cool Core Unifies Perseus's Radio and X-ray Halos"*, 2026, submitted to The Open Journal of Astrophysics.
2. P.F. Hopkins, **E.M. Silich**, J. Sayers, et al., *"Observational Implications of Cosmic Ray-Inverse Compton 'Boosted' Cool Cores in Clusters"*, 2026, submitted to The Open Journal of Astrophysics.
3. P. Domínguez Fernández, J.A. ZuHone, **E.M. Silich**, et al., *"ICM-SHOX. Paper III: The Case of MACS J0018.5+1626, a Radio Relic That Looks Like a Radio Halo?"*, 2026, The Astrophysical Journal, 1008, 43.
4. S.B. Ponnada, P.F. Hopkins, Y.S. Lu, et al. (including **E.M. Silich**), *"Strong Evidence for Cosmic Ray-Supported $\sim L_*$ Galaxy Halos via X-ray & tSZ Constraints"*, 2026, The Astrophysical Journal Letters, 997, L13.
5. B.J. Vaughan, J. Sayers, L. Spencer, et al. (including **E.M. Silich**), *"Measuring the Temperature of Extremely Hot Shock-Heated Gas in the Major Merger MACS J0717.5+3745 With Relativistic Corrections to the Sunyaev-Zel'dovich Effect"*, 2026, The Astrophysical Journal, 1000, 123.
6. P.F. Hopkins, E. Quataert, **E.M. Silich**, et al., *"Cosmic Rays Masquerading as Cool Cores: An Inverse-Compton Origin for Cool Core Cluster Emission"*, 2025, The Open Journal of Astrophysics, 8, 54053.
7. P.F. Hopkins, E. Quataert, S.B. Ponnada, & **E.M. Silich**, *"Cosmic Rays Masquerading as Hot CGM Gas: An Inverse-Compton Origin for Diffuse X-ray Emission in the Circumgalactic Medium"*, 2025, The Open Journal of Astrophysics, 8, 78.
8. A. Zajczyk, P. Kaaret, D. LaRocca, et al. (including **E.M. Silich**), "*On-Ground Calibration of the HaloSat Science Instrument"*, 2020, J. Astron. Telesc. Instrum. Syst. 6(4), 044005.
9. P. Kaaret, A. Zajczyk, D.M. LaRocca, et al. (including **E.M. Silich**), *"HaloSat - A CubeSat to Study the Hot Galactic Halo"*, 2019, The Astrophysical Journal, 884, 2.

Press Releases

1. *"Dark Matter Flies Ahead of Normal Matter in Mega Galaxy Cluster Collision"*, Caltech PR, July 2024. Read here.

Teaching

Ay 105: Optical Astronomy Instrumentation Lab	Graduate TA, Spring 2023
Ay 122c: High Energy Astronomical Measurements	Graduate TA, Winter 2023
Ay 127: Astrophysical Cosmology	Graduate TA, Fall 2022
PHYS 1611: Introductory Physics I	Undergraduate TA, Spring 2020
PHYS 1512: College Physics II	Undergraduate TA, Spring 2020

Fellowships & Awards (selected)

1. Smithsonian Astrophysical Observatory (SAO) Predoctoral Fellow	2024 - 2025
2. Garmire Scholar, France A Cordova Graduate Student Fund (Caltech)	2023
3. NSF Graduate Research Fellowship (GRFP)	2023 - 2026

4. Wallace L. W. Sargent Graduate Fellowship (Caltech) 2021 - 2022
5. Chambliss Astronomy Achievement Student Awards - Honorable Mention 2021
6. University of Iowa Dare to Discover 2021
7. Barry Goldwater Scholar 2020
8. James A. Van Allen Award (UI) 2020
9. John Mather Nobel Scholar (NASA/GSFC) 2020
10. Western Dubuque High School Young Accomplished Alumni 2020
11. APS Division of Astrophysics (DAP) Travel Grant 2020
12. Manuel Paul & Abraham Chinitz Liberal Arts & Sciences Scholarship (UI) 2019 - 2021
13. Myrtle K. Maier Scholarship (UI) 2019 - 2020
14. ICRU Academic Year Research Fellowship 2019 - 2020
15. NASA Iowa Space Grant Consortium Research Fellowship 2018 - 2020
16. Rhodes Dunlap Award for Excellence in the First/Second Year (UI) 2018 - 2020
17. ICRU Academic Year Research Fellowship 2018 - 2019
18. Charles A. Wert Summer Research Fund (UI) 2019
19. UI Department of Physics & Astronomy Poster Prize 2018, 2019
20. ICRU Summer Research Fellowship 2018

+4 others

Academic Presentations (selected)

Talks: *invited

1. *High-Energy Clusters & Cosmology Group Seminar, MPE. Garching, Germany. July 2026.
2. *8 th ICM Theory & Computation Workshop. Brno, Czech Republic. July 2026.
3. 248th American Astronomical Society (AAS) Meeting. Pasadena, CA. June 2026.
4. Observational Cosmology Seminar, Caltech. Pasadena, CA. June 2026, November 2024, October 2023, & February 2023.
5. *Dark Sector Meeting, NASA Jet Propulsion Laboratory (JPL). Pasadena, CA. May 2026.
6. *Tuesday UVa / NRAO Astronomy (TUNA) Lunch Talks. Charlottesville, VA. March 2026.
7. *Astronomy Colloquium, Green Bank Observatory. Green Bank, WV. March 2026.
8. *Astrophysics & Cosmology Seminar, University of California. Davis, CA. March 2026.
9. *Merging Cluster Workshop, Yonsei University. Seoul, South Korea. October 2025.
10. *Extragalactic Journal Club, MSU & University of Michigan, Virtual. October 2025.
11. mm Universe, KICP, University of Chicago. Chicago, IL. June 2025.
12. Astronomy Lunch Seminar. University of Massachusetts. Amherst, MA. October 2024.
13. Galaxy Clusters & Radio Relics II. CfA | Harvard & Smithsonian. Cambridge, MA. September 2024.
14. Multiphase Madness: Resolving the CGM in Theory and Observations. CfA | Harvard & Smithsonian. Cambridge, MA. August 2024.
15. *7 th ICM Theory & Computation Workshop. Ann Arbor, MI. June 2024.
16. *Galaxy Cluster Discussion Group Meeting, CfA | Harvard & Smithsonian. Cambridge, MA. February 2024 & November 2022.
17. *High Energy Astrophysics Seminar, CfA | Harvard & Smithsonian. Cambridge, MA. February 2024.
18. *Merging Cluster Workshop, Yonsei University. Seoul, South Korea. December 2023.
19. mm Universe, LPSC. Grenoble, France. June 2023.
20. 240th American Astronomical Society (AAS) Meeting, Pasadena, CA. June 2022.

21. Physics & Astronomy Colloquium, University of Iowa. Virtual. April 2021 & October 2020.
22. Conference for Undergraduate Women in Physical Sciences (WoPhyS), University of Nebraska. Lincoln, NE. November 2019.
23. Astrophysics & Space Physics Seminar, University of Iowa. Iowa City, IA. October 2019.

+5 others

Posters:

1. *8 th ICM Theory & Computation Workshop. Brno, Czech Republic. July 2026.
2. STScI Galaxy Clusters 2022: Challenging Our Cosmological Perspectives, Virtual. April 2022.
3. 237th American Astronomical Society (AAS) Meeting, Virtual. January 2021.
4. American Physical Society (APS) April Meeting, Virtual. April 2020.
5. APS CUWiP, University of Minnesota. Minneapolis, MN. January 2020.
6. Conference for Undergraduate Women in Physical Sciences (WoPhyS), University of Nebraska. Lincoln, NE. October 2018.

+3 others

Observing

Awarded PI telescope proposals (ground- and space-based):

XRISM (X-ray)

1. "*Separating dark matter and hot gas velocities in a unique merging cluster: first comparison of X-rays and the kSZ effect*", AO-1, ranked Priority C, 300 ks.

ALMA (mm/sub-mm)

1. "*Revealing the nature of the putative equatorial shock in the MACS J0018.5+1626 galaxy cluster merger with ALMA*", Cycle 12, ranked Priority C, 31 hrs.
2. "*Confirming a uniquely-oriented double cluster merger in MACS J2129.4-0741 with ALMA*", Cycle 13, ranked Priority C, 46 hrs.

GBT (mm/sub-mm)

1. "*Testing a CR-IC origin to the cooling flow problem with MUSTANG-2 and Chandra*", Semester 2026A, ranked Group B, 42 hrs.

Awarded Co-I telescope proposals (ground- and space-based):

Chandra (X-ray)

1. "*The Velocity-Space Decoupling of Gas and Dark Matter in MACS J0018.5+1626*", PI: Sayers, Cycle 26, 255 ks.
2. "*Multi-Probe Studies of Merging Galaxy Clusters*", PI: Sayers, Cycle 24, 170 ks.

XRISM (X-ray)

1. "*Resolving the Exceptional Velocity Structure in MACS J0717.5+3745*", PI: Sayers, AO-3, ranked Priority C, 300 ks.

Keck (optical)

1. "*The Velocity-Space Decoupling of Gas and Dark Matter in MACS J0018.5+1626*", PI: Sayers, Semester 2024B, 1 night on DEIMOS.

2. "*Multi-Probe Studies of Galaxy Cluster Merger Dynamics*", PI: Golwala, Semester 2024A, 2 nights on LRIS and 1 night on DEIMOS.
3. "*Multi-Probe Studies of Galaxy Cluster Merger Dynamics*", PI: Golwala, Semester 2023A, 2 nights on DEIMOS.
4. "*Multi-Probe Studies of Galaxy Cluster Merger Dynamics*", PI: Golwala, Semester 2022B, 1 night on LRIS and 0.5 nights on DEIMOS.

Ground-based observing experience:

1. Keck II Telescope, DEIMOS: 7.5 nights
2. Keck I Telescope, LRIS: 4 nights
3. Green Bank Telescope, *MUSTANG-2:* 20 hours

Mentoring

3 high school students from Gabrielino High School — Summer 2025
Visualization of galaxy cluster merger simulations with volume rendering techniques

3 high school students from Gabrielino High School — Summer 2024
Visualization of galaxy cluster merger simulations with volume rendering techniques

2 high school students from Gabrielino High School — Summer 2023
Data reduction of cluster-member optical spectroscopy from Keck/DEIMOS

Public Outreach

Lectures & speaking engagements:

1. Astronomy on Tap – Davis, *"Galaxy Clusters Collide: The Most Energetic Events since the Big Bang"*, Davis, CA. March 2026.
2. Astronomy on Tap – Death Valley, *"Galaxy Clusters Collide: The Most Energetic Events since the Big Bang"*, DVNP, CA. February 2025.
3. Caltech Stargazing Lectures, *"Galaxy Clusters Collide: The Most Energetic Events since the Big Bang"*, Pasadena, CA. August 2023. Watch here.
4. Death Valley Dark Sky Festival, *"Ask an Astrophysicist"* Q&A panelist, DVNP, CA. March 2023.

Science writing (and "Science writing"):

1. Altadena Poetry Review (digital anthology), *"Asymmetry"*. 2025. Read here.
2. Telegraph Herald, *"Cuts in federal funding for science would have long-term impacts"*. 2025.
3. Altadena Poetry Review (print anthology), *"Illustrations of Astrograd School"*. 2024. Nominated for the Pushcart Prize in Poetry.
4. Altadena Poetry Review (print anthology), *"An Experiment in Poetic Physics"*. 2024.
5. Astrobites, *"A Search for Dark Matter with HaloSat"*, 2021. Read here

Volunteering:

1. Astronomy on Tap – Los Angeles — Telescope operator, 2022 - *pres.*
2. Caltech Stargazing Lectures & Public Observing — Telescope operator, 2022 - *pres.*
3. Gabrielino High School physics classrooms — Lab assistant & speaker, 2021 - *pres.*
4. Death Valley Dark Sky Festival — Telescope operator, 2022 - 2025
5. Einstein Middle School science classrooms (Appleton, WI) — Guest speaker, 2026
6. Great Orion Dark Sky Festival (Panamint Valley, CA) — Guest speaker, 2025

7. Scouting America Troop 0175 (Epworth, IA) — Guest speaker, 2025
8. Girl Scouts Troop 6371 (Monrovia, CA) — Guest speaker, 2023
9. Iowa Center for Research by Undergraduates — Research ambassador, 2020 - 2021
10. Society of Physics Students, UIowa — Vice president & secretary, 2017 - 2021
11. Van Allen Observatory Public Observing — Telescope operator, 2017 - 2021
12. Drexler Middle School FIRST Lego League — Team mentor, 2018