Chelsea E. Harris

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Current position

Research Associate, Department of Physics and Astronomy, Michigan State University

- Co-PI NSF grant #2107070 "Constraining Type Ia Supernova Progenitors via their Environments" (PI L. Chomiuk)
- Hydrodynamic and radiation transport simulations of supernova interaction with circumstellar material; interpretation of radio, X-ray, optical, and UV datasets.

Education

2018 **PhD Astronomy & Astrophysics with a Designated Emphasis in Computational and Data Science and Engineering**. Dissertation Title: "One Shell, Two Shell, Red Shell, Blue Shell: Numerical Modeling to Characterize the Circumstellar Environments of Type I Supernovae". Committee: D. Kasen (Chair), P. Nugent, A. Filippenko, P.-O. Persson

2013 MA in Astrophysics, UC Berkeley

2012 BS in Physics, UC Santa Barbara (College of Creative Studies, Regents' Scholar)

Appointments held

06/20- *Research Associate*, Michigan State University, group of Prof. L. Chomiuk.

09/18-05/20 *Research Associate*, Michigan State University, group of Prof. S. Couch

06/18-08/18 *Interim Postdoctoral Researcher*, Lawrence Berkeley National Laboratory, group of Dr. P. Nugent

Areas of research in supernova astrophysics

Primary focus: Determining the progenitors of supernovae through computer simulations of ejecta interaction with the circumstellar medium.
Specializations: Type Ia supernovae, circumstellar environments, shocks, numerical hydrodynamics, radiation transport, synthetic observations, comparison to observations.
Related interests: extragalactic transients, stellar evolution, binary star processes, stellar mass loss and mass transfer, nucleosynthesis.

Methods

PROGRAMMING

Primary languages: Python, C, C++, PostgreSQL. **Secondary language:** Fortran 90.
Codes: `FLASH` (multiscale, multiphysics simulations), `Sedona` (Monte Carlo radiation transport and hydrodynamic solver), `SYNAPPS` (supernova spectrum modeling), `Superfit` (supernova spectrum matching).

OBSERVATIONS

Observed: three nights at the Lick Observatory with the 3-m Shane telescope + Kast double spectrograph. **Used/Obtained:** *Hubble Space Telescope*, WFC3/UVIS (awarded); *Swift*, XRT (awarded, PI); Arcminute Microkelvin Imager, 15.5 GHz radio (through collaboration); Jansky Very Large Array (awarded).

Research Mentoring

2020, 2021 Jacqueline Hernandez, Texas Christian University undergraduate (Michigan State REU student). Creating light-curves of Zwicky Transient Facility Type Ia Supernovae to search for interaction with circumstellar material at late-times.

2019 Brandon McIntyre, Michigan State undergraduate. Creating a grid of Red Super-Giant explosion models for use in Type IIP supernova microlensing simulations (`FLASH` code).

2018-2019 Cassandra Tang, UC Berkeley undergraduate. Styding the effect of mixing in simulations of the interaction of Type Ia supernovae with double-shell circumstellar structures (`RT1D` code).

Grants, honors & awards

2021 Co-PI, National Science Foundation Grant #2107070, "Constraining Type Ia Supernova Progenitors via their Environments" (3 year grant)

2019 Howes Scholar Award, Krell Institute (2 awarded; candidates nominated by advisor; for demonstration of "outstanding leadership, character and technical achievement in the field of computational science," in remembrance of Fredrick A. Howes)

2013 Computational Science Graduate Fellowship (CSGF), United States Department of Energy (10 awarded; applicants from fields of science, technology, engineering, and mathematics; open to U.S. only)

2013 Graduate Research Fellowship, National Science Foundation (*declined*; 2,000 awarded; applicants from all fields of research; open to U.S. only.)

2012 Research Award, UCSB Department of Physics (for outstanding effort in laboratory research)

2012 Academic Excellence Award, UC Santa Barbara Department of Physics (for successful completion of the Honors Program)

2012 Physics Highest Academic Honors, UC Santa Barbara Department of Physics (for maintaining a 3.8-4.0 GPA in upper division Physics courses)

2012 Distinction in the Major, UC Santa Barbara Department of Physics (for successful completion of a Senior Honors Thesis)

2011 Honorable Mention, Goldwater Scholarship (275 scholarships awarded, 198 honorable mentions; applicants from fields of mathematics, natural sciences, and engineering; open to U.S. only)

Telescope Time Allocations

2020 Co-I: "VLA observations of the youngest SNe Ia as a novel probe of progenitor scenarios" (VLA/20B-355). PI Sumit Sarbadhicary. Six hours.

2019 Co-I: "Characterizing a Nearby Normal Type Ia Supernova with Late-time CSM Interaction" (VLA/19A-451). PI Assaf Horesh. Very Large Array. Two hours.

2018 Co-I: "VLA Data on the Youngest SNe Ia Will Yield Unprecedented Progenitor Constraints" (VLA/18B-162). PI Laura Chomiuk. Very Large Array. Six hours.

2017 Co-I: "Characterizing the First Normal Type Ia Supernova with Late-time CSM Interaction" (VLA/17B-434). PI Assaf Horesh. Very Large Array. Two hours.

2017 Co-I: "NUV Monitoring of a SN Ia with Late-Onset CSM Interaction" (DD-15407). PI Melissa Graham. *Hubble Space Telescope*. One STIS spectrum, conditional three (3) orbits with WFC3/UVIS+275W.

2016 Co-I: "A NUV Imaging Survey for Circumstellar Material in Type Ia Supernovae" (GO-14779). PI Melissa Graham. *Hubble Space Telescope*. Eighty-three (83) Snapshot targets in Cycle 24 with WFC3/UVIS+F275W.

Professional Publications & Presentations

ORCiD: 0000-0002-1751-7474
ADS results

Journal Articles

2021 **Harris, Chelsea E.**, Chomiuk, L., Nugent, P. E., "Tumbling Dice: Radio Constraints on the Presence of Circumstellar Shells around Type Ia Supernovae with Impact Near Maximum Light"; *The Astrophysical Journal* 912:23

2020 **Harris, Chelsea E.**, Nugent, P. E., "Outside the Wall: Hydrodynamics of Type I Supernovae Interacting with a Partially Swept-up Circumstellar Medium"; *The Astrophysical Journal* 894:122

2019 **Harris, Chelsea E.**, Nugent, P. E., Horesh, A., and 12 coauthors, "Don't Blink: Constraining the Circumstellar Environment of the Interacting Type Ia Supernova 2015cp"; *The Astrophysical Journal* 868:21

2019 Graham, M. L., **Harris, Chelsea E.**, and 12 coauthors, "Delayed Circumstellar Interaction for Type Ia SN 2015cp Reveated by an HST Ultraviolet Imaging Survey"; *The Astrophysical Journal* 871:62

2017 Keel, W. C. and 9 coauthors including Harris, Chelsea E., "Cross-ionization of gas in AGN companion galaxies as a probe of AGN radiation in time and angle"; *ArXiv e-print*, arxiv:1711.09936

2017 Graham, M. L., **Harris, Chelsea E.**, and 5 coauthors "PTF11kx: A Type Ia Supernova with Hydrogen Emission Persisting After 3.5 Years"; *The Astrophysical Journal* 843:102

2016 **Harris, Chelsea E.**; Nugent, P.E.; Kasen, D.N.; "Against the Wind: Radio Light Curves of Type Ia Supernovae Interacting with Low-Density Circumstellar Shells"; *The Astrophysical Journal* 823:100

2015 Bennert, V.N. and 8 coauthors including Harris, Chelsea E., "A Local Baseline of the Black Hole Mass Scaling Relations for Active Galaxies. III. The Black Hole Mass - Velocity Dispersion Relation", *The Astrophysical Journal* 809:20

2014 Goobar, A. and 33 coauthors including Harris, Chelsea E., "The Rise of SN 2014J in the Nearby Galaxy M82", *The Astrophysical Journal* 784:12

2013 **Harris, Chelsea E.**, Bennert, V.N., Auger, M.W., Treu, T., Woo, J.-H., Malkan, M.A., "A Local Baseline of Black Hole Mass Scaling Relations for Active Galaxies. II. Measuring Stellar Velocity Dispersion in Active Galaxies", *The Astrophysical Journal Supplement Series* 201:29

2012 Keel, W. C. and 10 coauthors including Harris, Chelsea E., "The Galaxy Zoo survey for Giant AGN-ionized clouds: past and present black hole accretion events", *Monthly Notices of the Royal Astronomical Society* 420:878

2011 Barth, A.J. and 48 coauthors including Harris, Chelsea E., "The Lick AGN Monitoring Project 2011: Reverberation Mapping of Markarian 50", *The Astrophysical Journal* 743:4

2011 Barth, A.J. and 47 coauthors including Harris, Chelsea E., "Broad-line Reverberation in the Kepler-field Seyfert Galaxy Zw 229-015", *The Astrophysical Journal* 743:4

TALKS

2019 "Which SNe Ia Come from the Single Degenerate Channel? The Answer Will Shock You." *Midwest Workshop on Supernovae and Transients*, University of Chicago

2018 "Interpreting the Radiation from SNe interacting with CSM." *Zwicky Transient Facility Theory Network Meeting*, Kavli Institute for Theoretical Physics, University of California at Santa Barbara

2018 "Studying the Circumstellar Medium of SNe Ia in the Near-Infrared." *New Advances in NIR Type Ia Supernova Science*, University of Pittsburgh

2017 "Supernovae Interacting with Circumstellar Material." *LSST: The Supernova Revolution*, Center for Interdisciplinary Exploration and Research in Astrophysics at Northwestern University

2016 "Circumstellar Shells around Type Ia Supernovae." *The Ninth Harvard-Smithsonian Conference on Theoretical Astrophysics: The Transient Sky*, Harvard University

2014 "Detecting Circumstellar Mass in Type Ia Supernovae." *Kavli Institute for Cosmological Physics*, University of Chicago

Community Work

TOWARD ASTRONOMERS

Allocation Committees

(Years are excluded to protect the privacy of the process.)

- *Chandra* space telescope time allocation committee
- NASA Astrophysics Data Analysis Program (ADAP) review committee
- manuscript reviewer, *The Astrophysical Journal*

Teaching

2021 Course Instructor, ISP 205 "Visions of the Universe" – Michigan State University

2019 Lecturer, "The Many Explosions of White Dwarf Stars" – JINA First Frontiers Summer School, Michigan State University (hour-long talk)

2018 Graduate Student Instructor, Astronomy 207 (graduate inter-disciplinary): "Python Computing for Data Science", Prof. Joshua Bloom, UC Berkeley

2016 Lecturer, Astronomy 2 (undergraduate non-major): "History of the Universe", Prof. D. Andrew Howell, UC Santa Barbara (hour-long guest lecture)

2013 Graduate Student Instructor, Astronomy C10 (undergraduate non-major): "Introduction to General Astronomy", Prof. Alex Filippenko, UC Berkeley

Professional Mentoring

2021- Facilitator, Physics-Astronomy Drew Outreach Work AssociatioN *(Freshman and Sophomore undergraduate students from the Drew Scholars program [STEM majors from under-*

2018- *represented backgrounds] participate in astronomy and physics outreach.)* Postdoc leader and co-founder, Stellar Mentorship Program, Michigan State University *(Connecting MSU postdocs with an astronomy faculty mentor outside their research group for career support.*

2016-2018 graduate student mentor to a graduate student, Department of Astronomy Graduate Student Mentorship Program, UC Berkeley

2012-2014 graduate student mentor to three undergraduate students, COMPASS project, UC Berkeley

Selected Talks

2021 how to become a professional astronomer, Drew Scholars professional development seminar series, Sophomore level the importance of mental health in academic success, Drew

2018 Scholars professional development seminar series, Freshman level "Making a Talk" (tips and advice for science presentations) – Graduate Student Postdoc Seminar, Astronomy Department, UC Berkeley

2017 "Homophily" (review of research into the phenomenon of homophily, which affects the building of diverse communities) – AstroJustice group, UC Berkeley

2016 "UC Berkeley Mental Health Conference 2016, Confronting Mental Health Stigmas: takeaway messages for our department" – Astronomy Department Lunch Talk Series, UC Berkeley

Conference Organizer

2019 local organizer, JINA First Frontiers Summer School, Joint Institute for Nuclear Astrophysics, Michigan State University

Toward Non-Astronomers

2020-2021 Co-organizer, Lansing Astronomy on Tap

Workshops

2020 Paint-Along: Supernova 1991T and quarantine feelings (supernovae and spectra). Abrams Planetarium (online)

2018 Workshop developer and leader, "Our PEARTHfect Planet" (planet habitability). For ages 3-16 years. Nature Night, Michigan State University Observatory

2016-2017 Workshop leader, stellar nucleosynthesis. For junior high school women. Expand Your Horizons, Saint Mary's College.

2014-2016 Cal Day annual volunteer, Department of Astronomy: taught astronomy concepts to children through hands-on activities

Talks

2020 "The Science of Star Wars" *Abrams Planetarium*, Facebook Live

2019 "Let's use magnets to blow stars up!" – Astronomy on Tap Lansing

2018 "What makes cosmological supernovae?" – Astronomy on Tap Lansing

2017 "Is the companion to a Type Ia supernova literally the Predator?" – Chabot Space & Science Center Volunteer Enrichment Series (July)

2017 (Invited) "The Science of Star Wars", Astro Night, UC Berkeley (May 4)

2016 (Invited) "The Science of Star Wars", Astronomy on Tap Santa Barbara (May 4)

2014 Supernova researcher point of contact for donors, Lick Observatory viewing of SN 2014J for members of the Lick Council and Friends of Lick