NICHOLAS EARL

Chicago, IL (517) 402-4590 nmearl2@illinois.edu nmearl nicholasearl.me

PROFESSIONAL SUMMARY

I am a research software engineer and astrophysicist whose career has centered on building and sustaining open-source tools for the astronomy community, primarily within the Astropy ecosystem and in support of data analysis and visualization. My astrophysical research focuses on tidal disruption events and nuclear variability, where I use probabilistic modeling and machine learning to study black hole growth and galaxy evolution at survey scale.

EDUCATION

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN | *Ph.D. in Astronomy* — Aug 2020 – Present

- Advisor: *K. Decker French*
- Thesis: *Transient Accretion Disk Characterization & Machine Learning Pipelines for Transient Identification*
- Defense date: 6/19/2026

SAN DIEGO STATE UNIVERSITY | *M.S. in Astronomy* — Aug 2012 – May 2014

- Advisor: *Jerome Orosz*
- Thesis: *Photodynamical Modeling of Hierarchical Stellar System KOI-126*

MICHIGAN STATE UNIVERSITY | *B.S. in Astrophysics* — Aug 2007 – May 2011

- Honors College
- Advisor: *Brian O'Shea*
- Thesis: *Dynamic Evolution and Metal Mixing in Supernova Shock Remnants*

MICHIGAN STATE UNIVERSITY | *B.A. in Philosophy* — Aug 2007 – May 2011

- Honors College
- Advisor: *Debra Nails*
- Thesis: *Supervenience for an Infinity of Minds*

PROFESSIONAL EXPERIENCE

HARVARD-SMITHSONIAN CENTER FOR ASTROPHYSICS

Software Engineer & Systems Architect | *NASA/NSF-supported projects* — Jun 2021 – Present

- Architect and develop Cosmic Data Stories (CosmicDS) under NASA Science Activation (SciAct) grant, an interactive STEM curriculum platform built within the Glue ecosystem, enabling scientists to create linked-view, data-driven narratives without web-development expertise.
- Lead design of scalable pipelines for story authoring (Jupyter + web components), supporting adoption across middle school, high school, and introductory college courses.
- Architect and maintain CosmicDS deployment and operations infrastructure, including AWS services, Docker container management, database setup, API access control, and production configuration.
- Contribute directly to Glue and Jupyter interoperability layers, improving linked-view visualization and large dataset responsiveness.
- Collaborate with NASA, NSF, and CfA teams on learning goals, accessibility, and open-science reproducibility across CosmicDS modules.
- Through CfA, contribute to joint Earth-2 / NVIDIA efforts on GPU-accelerated climate and astrophysics workflows; explore real-time data federation, interactive visualization, and AI-assisted surrogate modeling for scientific simulations.

- Participate in the development of LIVE Environments, integrating Earth-2-style GPU pipelines into immersive astronomical and Earth-science data exploration tools.

University of Illinois Urbana-Champaign — Urbana, IL

Graduate Research Assistant | *Ph.D. Research* — Jan 2021 – Present

- Investigate nuclear transients, TDEs, and AGN using multi-wavelength photometry and spectroscopy; connect transient behavior to host-galaxy demographics and SMBH accretion physics.
- Led multi-wavelength analysis of AT 2020nov, identifying disk reprocessing signatures and late-time X-ray behavior.
- Developed FEADME, a GPU-accelerated Bayesian modeling engine (JAX/NumPyro) for relativistic elliptical accretion-disk profiles; applied to large AGN/TDE samples to contrast disk geometry and evolution.
- Developed NAPTIME, a neural-process framework for Rubin/LSST-scale early-time transient classification, incorporating calibrated uncertainties and irregularly sampled context/target splits.
- Lead EDGE–CALIFA angular-momentum analysis combining eCALIFA stellar kinematics with integrated and resolved CO products to study molecular gas content, structure, and kinematic alignment across the galaxy angular-momentum sequence.
- Design and develop a transformer-based transient classification system to distinguish AGN variability from TDE behavior by integrating multi-wavelength context, stochastic variability, and sequence modeling.
- Active member of the Young Supernova Experiment (YSE) and the LSST TVS TDE subgroup, contributing to transient discovery, simulation, and Rubin-era follow-up strategies.
- Participate in YSE triaging of newly observed fields to identify early supernovae, nuclear flares, and TDE candidates; contribute to early-alert vetting, prioritization, and rapid follow-up coordination.
- Develop infrastructure and catalog integration tools for OTTER (Open mulTiwavelength Transient Event Repository).

Graduate Teaching Associate — Aug 2020 – Jan 2021

- Taught introductory astronomy concepts to undergraduate students through virtual learning labs.
- Ran office hours, performed grading duties, and provided additional learning spaces for students.

Space Telescope Science Institute — Baltimore, MD

Senior Software Engineer — Jan 2018 – Aug 2020

- Chaired Spectroscopic Coordination Committee; advanced interoperability across Astropy and next-generation analysis tools, including Glue-Viz, for JWST data analysis.
- Served as an Astropy Core Developer and package lead for Astropy's spectroscopic tools, including Specutils; guided API design, spectral data model development, and community-facing analysis infrastructure; coordinated releases, maintained pytest test suites, managed CI pipelines via GitHub Actions, and contributed Sphinx documentation across the Astropy ecosystem.
- Led cross-instrument, cross-observatory software delivery for JWST science pipelines; collaborated with community developers to integrate STScI workflows into open-source tools.
- Drove notebook-native user tools (Glue/Jupyter) to broaden access to spectroscopic analysis; organized technical colloquia and community hack days.
- Diagnosing the Multiphase CGM (PI): Led development of Spectacle, an automated kinematic line-analysis package for synthetic and observed absorption spectra; quantified resolution-dependent CGM kinematics and compared simulations with HST/COS observations.
- Small-scale Structure of the CGM (Co-I): Ran high-resolution galaxy simulations to resolve sub-kpc CGM structure, modeling mixing, cooling, and absorber formation consistent with COS constraints.
- Grizli / WFC3/IR Spectroscopy: Reduced slitless spectroscopy for the full G102+G141 archive and delivered uniform redshifts and emission-line fluxes; supported dust/attenuation studies and luminosity-function analyses for HST and JWST preparatory science.

Senior Research & Instrument Analyst Jun 2014 – Jan 2018

- Led teams to deliver cross-instrument spectroscopic tools; coordinated reference-file production for MIRI; verified algorithms with instrument teams.
- Contributed to JWST Exposure Time Calculator (ETC) and collaborative web application.
- Developed the JWST ETC and shipped collaborative analysis features; led 3–5-person coding sprints for astronomy software delivery.
- Built interactive tools for spectroscopic exploration; coordinated MIRI reference files and validation workflows.
- Led development of Spectacle, a synthetic/observational line-analysis package for CGM studies.
- Quantified resolution-dependent CGM kinematics in hydro simulations; compared simulated and observed absorbers to characterize multiphase structure.

San Diego State University — San Diego, CA

Graduate Research Assistant Aug 2012 – May 2014

- Worked with Dr. Jerome Orosz and Dr. William Welsh on master's thesis research characterizing compact multi-body stellar and exoplanetary systems identified in the Kepler telescope field.
- Developed and extended ELC and Pynamic modeling tools for photodynamical analysis of eclipsing hierarchical systems, combining orbital dynamics, light-curve modeling, and parameter inference.
- Built computational analysis programs to process Kepler photometry, identify instrumental and astrophysical systematics, and refine physical parameters for multi-body systems.

Graduate Teaching Associate Aug 2012 – May 2013

- Taught undergraduate astronomy laboratory courses for Dr. Orosz and Dr. Sandquist, including lecturing, hands-on experimentation, and trips to SDSU's Mount Laguna Observatory.

GRANTS, AWARDS, & FELLOWSHIPS

2025 First Author Publication Award, University of Illinois Urbana-Champaign

2021, 2023 Center for AstroPhysical Surveys Fellowship, University of Illinois Urbana-Champaign.

2018 STScI Achievement Award – Spectroscopy Visualization Tools, Space Telescope Science Institute.

2017 STScI Achievement Award – JWST ETC for CfP, Space Telescope Science Institute.

2017 Resolving the Small-scale Structure of the CGM, HST Program AR-15012 (Co-I).

2016 Diagnosing the Multiphase CGM, HST Program AR-14560 (PI).

CONFERENCE & INVITED TALKS

AT2020nov: Rare Transient Event in a Pre-Existing Accretion Disk

- Boom! Transient Workshop at UIUC, Champaign, IL, 2022.
- Transient and Variable Universe Conference at UIUC, Champaign, IL, 2023.
- The Restless Nature of AGN, Naples, Italy, 2023.

Photospheric Disk Modeling with Multi-Wavelength Photometry

- Anticipating the Rising Tide of Tidal Disruption Events Conference at KITP, Santa Barbara, CA, 2024.

Bayesian Modeling for Accretion Disk Analysis

- Invited Talk at UC Santa Cruz, CA, 2024.

Neural Processes for TDE Identification & Forecasting

- Invited Talk at NCSA Center for AstroPhysics, UIUC, Champaign, IL, 2024.
- SkAI Hackathon at SkAI Institute, Chicago, IL, 2026.

GPU-Accelerated Bayesian Modeling for Accretion Disks using JAX

- X-ray Quasi-Periodic Eruptions & Repeating Nuclear Transients Conference at the European Space Astronomy Centre (ESAC) in Madrid, Spain, 2025.
- European Astronomical Society conference in Cork, Ireland, 2025.

Mapping Molecular Gas Bimodalities in the Angular Momentum Plane with EDGE-CALIFA

- EDGE Splinter Workshop at UIUC, Champaign, IL, 2026.

MENTORING & OUTREACH ACTIVITIES

Mentoring

- **Society for Equity in Astronomy Mentorship Program:** Mentored two astronomy undergraduates through UIUC's Society for Equity in Astronomy mentorship program, supporting academic planning, research preparation, and professional development.
- **Warrior-Scholar Project at UIUC:** Served twice as Project Lead for UIUC Warrior-Scholar Project programming, supporting academic bridge experiences for student veterans entering or returning to higher education.

Activities

- **UIUC Society for Equity in Astronomy:** Secretary for graduate-student-led astronomy equity group supporting inclusive departmental programming and community-building.
- **2022 UIUC AstroFest:** Organizer for annual astronomy research event featuring talks, posters, and department-wide scientific exchange.
- **Astropy Coordination Conference 2019:** Scientific organizing committee member for community meeting supporting coordination across the Astropy open-source astronomy software ecosystem.
- **Python in Astronomy 2019:** Scientific organizing committee member for conference bringing together astronomy Python developers, educators, and contributors through talks, tutorials, unconference sessions, and sprints.
- **San Diego State's Schwartz Astronomical Society:** Council member of SDSU astronomy student society supporting student community, rooftop observing, and astronomy events.
- **Society of Physics Students at Michigan State University:** Member of MSU chapter connecting physics and astronomy students through talks, career preparation, research discussions, and student community.

Outreach

- **Sexual-Orientation and Gender Minorities in Astronomy (SGMA):** Member of AAS committee supporting equality, visibility, and professional inclusion for sexual-orientation and gender minorities in astronomy.
- **OUT in Science, Technology, Engineering, and Mathematics (oSTEM):** Member of national LGBTQ+ STEM organization supporting community building, professional development, and educational programming.
- **The Alliance LGBT Group at Michigan State University:** Member of MSU student organization advocating for queer and allied students and supporting campus LGBTQ+ community.
- **MLO Summer Visitor's Program (SDSU):** Organizer for Mount Laguna Observatory public visitor programming connecting the San Diego community with telescope observing and astronomy education.
- **STEM Exploration Day (SDSU):** Organizer for hands-on STEM outreach introducing students and community participants to science activities and pathways.
- **Little Einsteins (SDSU):** Organizer for youth-focused science outreach introducing astronomy and STEM concepts to younger learners.
- **Astronomy Nights on the Roof (SDSU):** Organizer for rooftop observing events with telescopes, informal instruction, and public engagement.
- **Sidewalk Astronomy (STScI):** Organizer for accessible public observing sessions bringing telescopes and astronomy conversations into shared community spaces.

TECHNICAL SKILLS

Scientific Programming Python (primary), NumPy, SciPy, Matplotlib, C/C++, Rust, FORTRAN; additional experience with C#, Julia, MATLAB, and IDL.

Machine Learning & Inference JAX, NumPyro, PyTorch; Bayesian inference, Gaussian and Neural Processes, variational inference, time-series and spectral modeling; uncertainty quantification.

High-Performance Computing GPU acceleration, JIT compilation, parallelization; experience with large simulation datasets and survey-scale pipelines.

Data & Visualization Astropy ecosystem (Specutils, JDAViz), Glue/Glue-Viz, Jupyter; FITS, HDF5, CSV, and survey data products; interactive and linked-view visualization.

Software Engineering Practices Git/GitHub, GitHub Actions, pytest, Sphinx, CI/CD, code review, issue triage, release coordination, and user documentation.

Web & Infrastructure AWS, JavaScript/TypeScript, React/Vue; scientific web applications and cloud-deployed analysis tools.

Platforms Linux/Unix, macOS, Windows.

SELECT OPEN-SOURCE PROJECTS

- **[Lead Developer] NAPTIME (Neural Astrophysical Photometric Transient Identification and Modeling Engine):** Neural-process framework for Rubin-era photometric transient classification and TDE-focused candidate recovery.
- **[Lead Developer] FEADME (Fast Elliptical Accretion Disk Modeling Engine):** GPU-accelerated Bayesian fitting framework for modeling double-peaked and broad-line AGN/TDE spectra.
- **[Lead Developer] Cosmic Data Stories (CosmicDS):** NASA-/NSF-supported interactive data-story platform for STEM classrooms, built within the Glue-Viz ecosystem.
- **[Lead Developer] ipywwt / solara-state:** Supporting packages for interactive scientific web applications, including WorldWide Telescope integration in Jupyter and reusable state-management infrastructure for Solara-based tools.
- **[Developer] Glue / Glue-Viz:** Linked-data visualization framework for multidimensional datasets; contributed to core and web/Jupyter interoperability layers.
- **[Developer] OTTER (Open mulTiwavelength Transient Event Repository):** Public repository and analysis platform for multiwavelength transient events; developed infrastructure and catalog integration.
- **[Former Lead Developer] JDAViz / SpecViz / CubeViz / MOSViz:** Next-generation visualization and analysis tools in the Astropy ecosystem.
- **[Former Lead Developer] Specutils:** Core spectral analysis library in the Astropy ecosystem; contributed models, algorithms, and infrastructure for 1D spectral manipulation and calibration.
- **[Developer] Astropy:** Contributor to the Astropy project, including gWCS and spectroscopic infrastructure, supporting community-wide standards for astronomical analysis.
- **[Developer] Pandeia (JWST ETC):** Analytical engine and collaborative web app for JWST exposure time calculation.
- **[Lead Developer] Spectacle:** Line analysis framework for synthetic and observational spectra.
- **[Lead Developer] Pynamic / ELC:** Photodynamical and binary-modeling toolsets.

PUBLICATIONS

Papers in Progress

1. **Earl, N.**, et al., in prep., NAPTIME: A Neural-Process Framework for Family-Level Rubin Alert Classification with a Tidal Disruption Event Focus.

2. **Earl, N.**, EDGE–CALIFA Collaboration, et al., in prep., Stellar Angular Momentum and Molecular Gas Across the EDGE–CALIFA Sample.

Preprints

1. Shepherd, M., et al., incl. **Earl, N.**, 2026, The Delay Time Distribution of Tidal Disruption Events, *arXiv e-prints*, doi:10.48550/arXiv.2604.04831.
2. Patra, K., Liepold, E., **Earl, N.**, et al., 2026, JWST and Keck observations of the off-nuclear tidal disruption event TDE 2025abcr: An evolving reprocessing layer, *arXiv e-prints*, arXiv:2604.16093.
3. Verrico, M., et al., incl. **Earl, N.**, 2026, Identifying Changing-Look AGN Transitions in Light Curve Data with the Zwicky Transient Facility, *arXiv e-prints*, doi:10.48550/arXiv.2604.12109.
4. **Ear, N.**, et al., 2025, FEADME: Fast Elliptical Accretion Disk Modeling Engine, *arXiv e-prints*, 10.48550/arXiv.2512.10228.
5. Patra, K., Foley, R., **Earl, N.**, et al., 2025, JWST and Keck Observations of the Off-Nuclear TDE AT 2024tvd: A Massive Nuclear Star Cluster and Minor-Merger Origin for its Black Hole, *arXiv e-prints*, doi:10.48550/arXiv.2510.12572.
6. Jacobson-Galan, W., et al., incl. **Earl, N.**, 2025, An Updated Detection Pipeline for Precursor Emission in Type II Supernova 2020tlf, *arXiv e-prints*, doi:10.48550/arXiv.2501.08475.

Refereed

1. Franz, N., et al., incl. **Earl, N.**, 2026, The Open mulTiwavelength Transient Event Repository (OTTER): Infrastructure Release and Tidal Disruption Event Catalog, *The Astrophysical Journal*, 999, 243, doi:10.3847/1538-4357/ae346e.
2. Izzo, L., et al., incl. **Earl, N.**, 2026, Normal or transitional? The evolution and properties of two type Ia supernovae in the Virgo cluster, *Astronomy & Astrophysics*, 706, A381, doi:10.1051/0004-6361/202556425.
3. French, K., et al., incl. **Earl, N.**, 2025, Radio Variability in Recently Quenched Galaxies: The Impact of Tidal Disruption Event or Active Galactic Nucleus-Driven Outflows, *The Astrophysical Journal*, 992, 123, doi:10.3847/1538-4357/adff7a.
4. Jacobson-Galan, W., et al., incl. **Earl, N.**, 2025, Final Moments. III. Explosion Properties and Progenitor Constraints of CSM-interacting Type II Supernovae, *The Astrophysical Journal*, 992, 100, doi:10.3847/1538-4357/adfa23.
5. Hayes, E., et al., incl. **Earl, N.**, 2025, Characterizing the standardization properties of type Ia supernovae in the z band with hierarchical Bayesian modelling, *Monthly Notices of the Royal Astronomical Society*, 541, 1948–1968, doi:10.1093/mnras/staf1056.
6. Messick, A., et al., incl. **Earl, N.**, 2025, A Large-scale Search for Photometrically Variable Active Galactic Nuclei in Dwarf Galaxies Using the Young Supernova Experiment, *The Astrophysical Journal*, 985, 223, doi:10.3847/1538-4357/adcdff.
7. **Earl, N.**, et al., 2025, AT 2020nov: Evidence for Disk Reprocessing in a Rare Tidal Disruption Event, *The Astrophysical Journal*, 983, 28, doi:10.3847/1538-4357/adb974.
8. Jacobson-Galan, W., et al., incl. **Earl, N.**, 2025, An Updated Detection Pipeline for Precursor Emission in Type II Supernova 2020tlf, *Research Notes of the American Astronomical Society*, 9, 5, doi:10.3847/2515-5172/ada367.
9. Jacobson-Galan, W., et al., incl. **Earl, N.**, 2024, Final Moments. II. Observational Properties and Physical Modeling of Circumstellar-material-interacting Type II Supernovae, *The Astrophysical Journal*, 970, 189, doi:10.3847/1538-4357/ad4a2a.
10. Wang, Q., et al., incl. **Earl, N.**, 2024, A low-mass helium star progenitor model for the Type Ibn SN 2020nxt, *Monthly Notices of the Royal Astronomical Society*, 530, 3906–3923, doi:10.1093/mnras/stae1038.
11. Ward, S., et al., incl. **Earl, N.**, 2023, Relative Intrinsic Scatter in Hierarchical Type Ia Supernova Sibling Analyses: Application to SNe 2021hpr, 1997bq, and 2008fv in NGC 3147, *The Astrophysical Journal*, 956, 111, doi:10.3847/1538-4357/acf7bb.

12. Davis, K., et al., incl. **Earl, N.**, 2023, SN 2022ann: a Type Icn supernova from a dwarf galaxy that reveals helium in its circumstellar environment, *Monthly Notices of the Royal Astronomical Society*, 523, 2530–2550, doi:10.1093/mnras/stad1433.

13. French, K., **Earl, N.**, et al., 2023, Fading AGNs in Poststarburst Galaxies, *The Astrophysical Journal*, 950, 153, doi:10.3847/1538-4357/acd249.

14. Gardner, J., et al., incl. **Earl, N.**, 2023, The James Webb Space Telescope Mission, *Publications of the Astronomical Society of the Pacific*, 135, 068001, doi:10.1088/1538-3873/acd1b5.

15. Aleo, P., et al., incl. **Earl, N.**, 2023, The Young Supernova Experiment Data Release 1 (YSE DR1): Light Curves and Photometric Classification of 1975 Supernovae, *The Astrophysical Journal Supplement Series*, 266, 9, doi:10.3847/1538-4365/acbfba.

16. Angus, C., et al., incl. **Earl, N.**, 2022, A fast-rising tidal disruption event from a candidate intermediate-mass black hole, *Nature Astronomy*, 6, 1452–1463, doi:10.1038/s41550-022-01811-y.

17. Astropy Collaboration, et al., incl. **Earl, N.**, 2022, The Astropy Project: Sustaining and Growing a Community-oriented Open-source Project and the Latest Major Release (v5.0) of the Core Package, *The Astrophysical Journal*, 935, 167, doi:10.3847/1538-4357/ac7c74.

18. Rest, A., et al., incl. **Earl, N.**, 2022, The DECam Young Supernova Experiment, *Transient Name Server AstroNote*, 24, 1.

19. Jacobson-Galan, W., et al., incl. **Earl, N.**, 2022, Final Moments. I. Precursor Emission, Envelope Inflation, and Enhanced Mass Loss Preceding the Luminous Type II Supernova 2020tlf, *The Astrophysical Journal*, 924, 15, doi:10.3847/1538-4357/ac3f3a.

20. Peeples, M., et al., incl. **Earl, N.**, 2019, Figuring Out Gas & Galaxies in Enzo (FOGGIE). I. Resolving Simulated Circumgalactic Absorption at $2 \leq z \leq 2.5$, *The Astrophysical Journal*, 873, 129, doi:10.3847/1538-4357/ab0654.

21. Astropy Collaboration, et al., incl. **Earl, N.**, 2018, The Astropy Project: Building an Open-science Project and Status of the v2.0 Core Package, *The Astronomical Journal*, 156, 123, doi:10.3847/1538-3881/aabc4f.

22. Batalha, N., et al., incl. **Earl, N.**, 2017, PandExo: A Community Tool for Transiting Exoplanet Science with JWST & HST, *Publications of the Astronomical Society of the Pacific*, 129, 064501, doi:10.1088/1538-3873/aa65b0.

23. Pontoppidan, K., et al., incl. **Earl, N.**, 2016, Pandeia: a multi-mission exposure time calculator for JWST and WFIRST, *Observatory Operations: Strategies, Processes, and Systems VI*, 9910, 991016, doi:10.1117/12.2231768.

Software

1. Jdaviz Developers, et al., incl. **Earl, N.**, 2025, Jdaviz, Zenodo, doi:10.5281/zenodo.17211099.

2. **Earl, N.**, et al., 2025, astropy/specutils: v2.1.0, Zenodo, doi:10.5281/zenodo.16615456.

3. Jdaviz Developers, et al., incl. **Earl, N.**, 2023, Jdaviz: JWST astronomical data analysis tools in the Jupyter platform, Astrophysics Source Code Library, ascl:2307.001.

4. Dencheva, N., et al., incl. **Earl, N.**, 2021, spacetelescope/gwcs: GWCS 0.18.0, Zenodo, doi:10.5281/zenodo.5800080.

5. Boyd, B., et al., incl. **Earl, N.**, 2020, SALSA: A Python Package for Constructing Synthetic Quasar Absorption Line Catalogs from Astrophysical Hydrodynamic Simulations, *The Journal of Open Source Software*, 5, 2581, doi:10.21105/joss.02581.

6. Ginsburg, A., et al., incl. **Earl, N.**, 2019, radio-astro-tools/spectral-cube: Release v0.4.5, Zenodo, doi:10.5281/zenodo.3558614.

7. Batalha, N., et al., incl. **Earl, N.**, 2019, PandExo: Instrument simulations for exoplanet observation planning, Astrophysics Source Code Library, ascl:1906.016.

8. Newville, M., et al., incl. **Earl, N.**, 2016, lmfit-py: release 0.9.3, Zenodo, doi:10.5281/zenodo.49428.

Abstracts & Theses

1. Udomprasert, P., et al., incl. **Earl, N.**, 2025, Cosmic Data Stories: Online Interactive Resources for Engaging the Public with NASA Data, American Astronomical Society Meeting Abstracts #245, 245, 318.02.
2. Harrington, J., et al., incl. **Earl, N.**, 2019, Support the Python Numerical Core, *Bulletin of the American Astronomical Society*, 51, 265.
3. **Earl, N.**, et al., 2018, Spectacle and SpecViz: New Spectral Analysis and Visualization Tools, American Astronomical Society Meeting Abstracts #231, 231, 150.20.
4. **Earl, N.**, et al., 2016, SpecViz: Interactive Spectral Data Analysis, American Astronomical Society Meeting Abstracts #228, 228, 317.05.
5. **Earl, N.**, et al., 2016, Diagnosing the Multiphase Circumgalactic Medium, HST Program AR-14560.
6. **Earl, N.**, 2015, Photodynamical modeling of hierarchical stellar system KOI-126, Master's thesis.
7. **Earl, N.**, et al., 2014, Analysis of Refined Parameters of the Eclipsing Hierarchical Triple Stellar System KOI-126, American Astronomical Society Meeting Abstracts #223, 223, 155.21.