

NICHOLAS M. EARL

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- EDUCATION**
- San Diego State University** – San Diego, CA AUG 2012 - MAY 2014
M.S. Astronomy
Advisor: Dr. Jerome Orosz
Thesis: “*Photodynamical Modeling of Hierarchical Stellar System KOI-126*”
- Michigan State University** – East Lansing, MI AUG 2007 - MAY 2011
B.S. Astrophysics, Honors College
Advisor: Dr. Brian O’Shea
Thesis: “*Dynamic Evolution and Metal Mixing in Supernova Shock Remnants*”
- Michigan State University** – East Lansing, MI AUG 2012 - MAY 2011
B.A. Philosophy, Honors College
Advisor: Dr. Debra Nails
Thesis: “*Supervenience for an Infinity of Minds*”
- RESEARCH**
- Space Telescope Science Institute** – Baltimore, MD JUN 2019 - PRESENT
- Grizli: The Grism redshift & Line Database for HST WFC3/IR Spectroscopy
Advisor: Dr. Ivelina Momcheva
PI: Dr. Ivelina Momcheva
Grant: HST Proposal 14553
- Utilize the “Grizli” software project to reduce slitless spectroscopy and provide uniform processing, redshift, and emission line measurements of the full WFC3 G102+G141 spectral archive. The project focuses on constraining the dust extinction towards HII regions in distant star-forming galaxies and determining robust emission line luminosity functions to help inform planning of future space-based cosmology missions such as WFIRST.
- Space Telescope Science Institute** – Baltimore, MD AUG 2015 - PRESENT
- Diagnosing the Multi-phase CGM
Advisor: Dr. Molly Peeples
PI: Nicholas Earl
Grant: HST Proposal 14560
- Explore resolution-dependence in hydrodynamic simulations on the internal kinematic structure of detected absorption in circumgalactic (CGM) spectra, and quantify the improved correlation between kinematics and CGM behavior with observed distributions of absorber properties.
- Develop new software package for automated line finding and fitting for use in hydrodynamically generated synthetic spectra pipelines, employing novel approaches to simultaneous line fitting, identification, and reduction of line properties.
- Space Telescope Science Institute** – Baltimore, MD AUG 2017 - JUN 2019
- Resolving the Small-Scale Structure of the Circumgalactic Medium in Cosmological Simulations
Advisor: Dr. Molly Peeples

PI: Dr. Lauren Corlies
Grant: HST Proposal 15012

Explored the kinematics of the low- z circumgalactic medium (CGM) through high-resolution cosmological galaxy simulations at scales required to resolve structures at the sub-kpc level. The simulations were built to examine how the physical nature of CGM gas is defined by mixing and cooling on scales expected from observations (e.g. HST/COS).

EXPERIENCE

Senior Software Engineer

JAN 2018 - PRESENT

Space Telescope Science Institute
Baltimore, MD

- Head the Spectroscopic Coordination Committee in the development of new core science software packages for integration into the Astropy project. Submit proposals for the enhancement of astronomical tools in the Astropy package, coordinate and lead the development of such tools, engage with community members from several institutions to collaborate on how to make already existing tools more interoperable with the Astropy ecosystem.
- Lead teams as a certified Scrum Master in Agile-style sprint-based science software development to deliver new astronomical tools for cross-instrument and cross-observatory data products for JWST. Collaborate with external software developers to integrate Space Telescope data product support into next-gen analysis software.
- Represent STScI in collaborative initiatives from the Harvard CfA and the Glue projects to develop new user packages for the Jupyter ecosystem to allow embedding of interactive tools inside notebooks, and access of the Glue package through shared kernels.
- Oversee the successful launch of the new Engineering Colloquium series at STScI as member of the Engineering & Technology Colloquium Committee; and, as a sitting member of OpenAstronomy's Python in Astronomy SOC, started organization work for the next international Python in Astronomy conference.
- Increase community engagement by representing STScI at several conferences with regards to building of tools and providing demonstrations of their usage; several successful institute hack days to further codify our analysis tools using modern and maintainable coding practices; organize and lead hack days at several astronomical conferences to involve the community with development efforts at STScI.

Senior Research & Instrument Analyst

APR 2016 – DEC 2017

Space Telescope Science Institute
Baltimore, MD

- Head the Spectroscopic Coordination Committee in the development of new core science software packages for integration into the Astropy project.
- Lead teams on science software development to deliver new astronomical tools for cross-instrument and cross-observatory data products.
- Fill lead position for the production and delivery of reference file data based on the Mid-Infrared Instrument specifications; coordinate teams on the development and refinement of algorithms; collaborated with core science teams on verification of products.
- Develop James Webb Space Telescope exposure time calculator and user-facing collaborative web application.

Research & Instrument Analyst II

JUN 2014 – APR 2016

Space Telescope Science Institute
Baltimore, MD

- Developed James Webb Space Telescope exposure time calculator and user-facing collaborative web application.

- Led teams of three to five people on coding sprints for the development and delivery of astronomical software.
- Created and released tools for the collaborative exploration of spectroscopic science products via interactive user software.
- Filled lead position for the production and delivery of reference file data based on the Mid-Infrared Instrument specifications; coordinate teams on the development and refinement of algorithms; collaborated with core science teams on verification of products.

Graduate Research Assistant
AUG 2012 – MAY 2014

San Diego State University
San Diego, CA

Worked with Dr. Jerome Orosz and Dr. William Welsh on computational analysis of Kepler field exoplanetary data. Contributions include several analysis programs to discern systematics of exoplanetary systems (see *Projects*).

Graduate Teaching Associate
AUG 2012 – MAY 2013

San Diego State University
San Diego, CA

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

Research Assistant
APR 2009 – AUG 2011

Michigan State University
East Lansing, MI

Ran computational simulations on supercomputing clusters to further explore astrophysical phenomena under the auspice of Dr. Brian O'Shea. Wrote software in several programming languages in order to analyze and synthesize data. Presented results in research paper and astronomical conferences.

Teaching Assistant
SEP 2008 – DEC 2009

Michigan State University
East Lansing, MI

Performed tasks such as grading, proctoring, hosting/help room sessions, and study sessions for undergraduate Astronomy courses. [14]

PUBLICATIONS

PUBLISHED REFEREED PAPERS

Molly S. Peeples, Lauren Corlies, Jason Tumlinson, Brian W. O'Shea, Nicolas Lehner, John M. O'Meara, J. Christopher Howk, **Nicholas Earl**, Britton D. Smith, John H. Wise, and Cameron B. Hummels. "Figuring Out Gas & Galaxies in Enzo (FOGGIE). I. Resolving Simulated Circumgalactic Absorption at $2 \leq z \leq 2.5$ ". In: *Astrophysical Journal* 873.2, 129 (Mar. 2019), p. 129. DOI: 10.3847/1538-4357/ab0654. arXiv: 1810.06566 [astro-ph.GA]

Astropy Collaboration et al. "The Astropy Project: Building an Open-science Project and Status of the v2.0 Core Package". In: *Astronomical Journal* 156.3, 123 (Sept. 2018), p. 123. DOI: 10.3847/1538-3881/aabc4f. arXiv: 1801.02634 [astro-ph.IM]

Natasha E. Batalha, Avi Mandell, Klaus Pontoppidan, Kevin B. Stevenson, Nikole K. Lewis, Jason Kalirai, **Nicholas Earl**, Thomas Greene, Loic Albert, and Louise D. Nielsen. "PandExo: A Community Tool for Transiting Exoplanet Science with JWST & HST". in: *Publications of the ASP* 129.976 (June 2017), p. 064501. DOI: 10.1088/1538-3873/aa65b0. arXiv: 1702.01820 [astro-ph.IM]

Klaus M. Pontoppidan, Timothy E. Pickering, Victoria G. Laidler, Karoline Gilbert,

Christopher D. Sontag, Christine Slocum, Mark J. Sienkiewicz, Christopher Hanley, **Nicholas M. Earl**, Laurent Pueyo, Swara Ravindranath, Diane M. Karakla, Massimo Robberto, Alberto Noriega-Crespo, and Elizabeth A. Barker. "Pandeia: a multi-mission exposure time calculator for JWST and WFIRST". in: *Proceedings of the SPIE, Volume 9910, id. 991016 15 pp.* (2016). Vol. 9910. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series. 2016, p. 991016. DOI: 10.1117/12.2231768

PUBLISHED NON-REFEREED PAPERS

Joseph Harrington, Ralf Gommers, Chelle Gentemann, Derek Buzasi, Kevin Stevenson, Joshua Pepper, Perry Greenfield, Shubham Kanodia, Thomas Beatty, Ryan Challenor, Joe Ninan, Jessie Christiansen, Arif Solmaz, Erik Tollerud, **Nicholas Earl**, Pey Lian Lim, Larry Bradley, Elisabeth Newton, Rachel Akeson, Megan Sosey, Philip Hodge, Paulo Miles-Páez, Kathleen Labrie, Henry Ngo, Sara Ogaz, Darren Williams, Michael Himes, Kathleen McIntyre, Adrienne Dove, Joshua Colwell, Joe Llama, Ryan T. Hamilton, Geert Barentsen, and Ryan Terrien. "Support the Python Numerical Core". In: *Bulletin of the AAS*. vol. 51. June 2019, p. 265

Nicholas Michael Earl. "Photodynamical modeling of hierarchical stellar system KOI-126". MA thesis. San Diego State University, Jan. 2015, (Work done as part of M.S. degree).

CONFERENCE POSTERS

Nicholas Earl, Molly Peeples, and JDADF Developers. "Spectacle and SpecViz: New Spectral Analysis and Visualization Tools". In: *American Astronomical Society Meeting Abstracts #231*. Vol. 231. American Astronomical Society Meeting Abstracts. Jan. 2018, p. 150.20

Nicholas Michael Earl and STSci. "SpecViz: Interactive Spectral Data Analysis". In: *American Astronomical Society Meeting Abstracts #228*. Vol. 228. American Astronomical Society Meeting Abstracts. June 2016, p. 317.05

Nicholas M. Earl, J. A. Orosz, and W. F. Welsh. "Analysis of Refined Parameters of the Eclipsing Hierarchical Triple Stellar System KOI-126". In: *American Astronomical Society Meeting Abstracts #223*. Vol. 223. American Astronomical Society Meeting Abstracts. Jan. 2014, p. 155.21, (Work done as part of M.S. degree).

Nicholas Earl. "Microstructure Formation in Stellar Shock Propagation". In: *American Astronomical Society Meeting Abstracts #217*. Vol. 217. American Astronomical Society Meeting Abstracts. Jan. 2011, p. 433.20, (Work done as part of B.S. degree).

SOFTWARE PUBLICATIONS

Adam Ginsburg, Thomas Robitaille, Eric Koch, Chris Beaumont, adamginsburg, John ZuHone, Brigitta Sipocz, Craig Jones, P. L. Lim, Erik Rosolowsky, **Nicholas Earl**, jrobbfed, shuokong, Amanda Kepley, Vlas Sokolov, The Gitter Badger, Sebastien Maret, Julián Garrido, Joseph Booker, and Erik Tollerud. *Radio-Astro-Tools/Spectral-Cube: V0.4.3 Release*. Version v0.4.3. Apr. 2018. DOI: 10.5281/ZENODO.1213217

Natasha E. Batalha, Avi Mandell, Klaus Pontoppidan, Kevin B. Stevenson, Nikole K. Lewis, Jason Kalirai, **Nicholas Earl**, Thomas Greene, Loic Albert, and Louise D. Nielsen. *PandExo: Instrument simulations for exoplanet observation planning*. June 2019. ascl: 1906.016

Matt Newville, Andrew Nelson, Till Stensitzki, Antonino Ingargiola, Dan Allan, Michal, Yoav Ram, MerlinSmiles, Li Li, Glenn, Christoph Deil, Gustavo Pasquevich, Stuermer, Tim Spillane, stonebig, Per A. Brodtkorb, **Nicholas Earl**, Anthony Almarza, Ben

Gamari, and Kostis Anagnostopoulos. *Lmfit-Py: Release 0.9.3*. Version 0.9.3. Apr. 2016. DOI: 10.5281/zenodo.49428

GRANT ACTIVITY

PI HST Program AR-14560. **Nicholas Earl**. *Diagnosing the Multiphase Circumgalactic Medium*. HST Proposal. Oct. 2016

Co-I HST Program AR-15012: Lauren Corlies. *Resolving the Small-Scale Structure of the Circumgalactic Medium in Cosmological Simulations*. HST Proposal. Aug. 2017

SCHOLARSHIP

Ruth and Clifford Smith Astronomy Fellowship. San Diego State University, 2013.

Hantel Fellowship. Michigan State University, 2010.

Dean's List. Michigan State University.

Honors College. Michigan State University.

AWARDS

STScI Achievement Award: For the implementing the James Webb Space Telescope Exposure Time Calculator in time for the Call for Proposals (CfP) release at the January AAS.

STScI Achievement Award: For developing a new generation of python-based spectroscopic visualization tools.

COMPUTER SKILLS

Languages: Python, C#, C++, C, Rust, FORTRAN, SQL, JavaScript, TypeScript, Ruby, Haskell, Julia, F#, Java, Objective-C, MATLAB, IDL.

Web Development: HTML, CSS/LESS/Sass, React, VueJS.

Operating Systems: Unix, Linux, FreeBSD, Mac OSX, Windows, Android, iOS.

PROJECTS

All open source software can be found at <https://github.com/nmearl>.

DEVELOPER

JDAViz: Web development using Backbone.js to allow code written in Python to be rendered for the web using the IPyWidgets toolkit and Jupyter kernel infrastructure. Development encompasses the next generation of web-accessible software for astronomical data analysis.

Specutils: Specutils is an Astropy affiliated package with the goal of providing a shared set of Python representations of astronomical spectra and basic tools to operate on these spectra.

SpecViz: One-dimensional interactive visualization and analysis tool for exploring spectroscopic data for the next generation of science products.

CubeViz/MOSViz: Visualization software integrated into the Glue project for interactive analysis of cube and multi-object spectroscopic data products.

Spectacle: Spectral line analysis and comparison framework for correlating spectra from both hydrodynamic simulations (i.e. synthetic spectra), and observational data.

Pandeia: Exposure time calculation (ETC) for the James Webb Space Telescope. Project includes development of an analytical engine for simulating JWST instrument behavior, and a robust and extensive web application built on Tornado to handle collaborative analysis.

Pyndamic: Photo-dynamical modeling package for fitting light curves in multi-body systems. The implementation involves refactored occlusion techniques and robust bayesian ensemble sampling for parameter estimation. Written in C, C++, and Python.

ELC: extensive binary modeling code written in FORTRAN.

CONTRIBUTOR

Astropy: A community effort to develop a common core package for Astronomy in Python and foster an ecosystem of interoperable astronomy packages.

Glue: Glue is a Python library to explore relationships within and among related datasets.

yt: Python package for analyzing and visualizing volumetric, multi-resolution data from astrophysical simulations, radio telescopes, and others, written in Python.

Enzo: Parallel code for astrophysical and cosmological simulations utilizing adaptive mesh refinement, written in C++.

CERTIFICATIONS • SCRUM ALLIANCE certified agile development ScrumMaster

OUTREACH

- Member of Sexual-Orientation and Gender Minorities in Astronomy (SGMA)
- Member of OUT in Sciences, Technology, Engineering, and Mathematics (oSTEM)
- Member of the The Alliance LGBT Group at Michigan State University (MSU)
- Organizer for MLO Summer Visitor's Program (SDSU)
- Organizer for STEM Exploration Day (SDSU)
- Organizer for Little Einsteins (SDSU)
- Organizer for Astronomy Nights on the Roof
- Organizer for Sidewalk Astronomy

ACTIVITIES

- Astropy Coordination Conference 2019 SoC Member
- Python in Astronomy 2019 SoC Member
- Council member of San Diego State's Schwartz Astronomical Society
- Society of Physics Students at Michigan State University
- Philosophy Club at Michigan State University
- Guest Columnist for The State News