

NICHOLAS MICHAEL EARL

Office Contact

3700 San Martin Dr
P613
Baltimore, MD 21218
(410) 338-4447
nearl@stsci.edu
<http://nicholasearl.me>

Education

M.S., Astronomy
San Diego State University, San Diego, CA
Date of Graduation: May, 2014
Advisor: Jerome Orosz
Thesis: “Photodynamical Modeling of Hierarchical Stellar Systems”

B.S., Astrophysics
Michigan State University, East Lansing, MI
Date of Graduation: May, 2011
Advisor: Brian O’Shea
Thesis: “Dynamic Evolution and Metal Mixing in Supernova Shock Remnants”

B.A., Philosophy
Michigan State University, East Lansing, MI
Date of Graduation: May, 2011
Advisor: Debra Nails
Thesis: “Supervenience for an Infinity of Minds”

Experience

Space Telescope Science Institute 6/2014—Present

Senior Software Engineer 11/2018—Present

See below.

Software Engineer II 1/2018—11/2018

RESEARCH

- Explore resolution-dependence in hydrodynamic simulations on the internal kinematic structure of detected absorption in CGM spectra, and quantify the improved correlations 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 ion properties.
- Collaborate cross-institutionally on the creation of web-based tools to

access large datasets hosted on remote servers, allowing users the ability of deep astronomical data analysis without the need to store copies of the data locally via JupyterLab extensions and web-based analysis tools written to be remotely accessible.

MISSION SUPPORT

- 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

4/2016—12/2017

SCIENCE RESEARCH

- Create a novel analysis package for the reduction of spectroscopic data using modern comparison metrics, powerful reduction tools, and leveraging new statistical methods for searching large parameter spaces.
- Construct simulation-to-archive pipeline for the expansion of the MAST database to include synthetic spectral generated from hydrodynamical simulations as companion references to observation data.
- Develop robust metric and comparison framework for the correlation of observed spectra to synthetic spectra as a means for discerning astrophysics processes of galaxy evolution.

MISSION SUPPORT

- 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

6/2014—4/2016

RESEARCH

- Constructing simulation-to-archive pipeline for the expansion of the MAST database to include synthetic spectral generated from hydrodynamical simulations as companion references to observation data.
- Developed robust metric and comparison framework for the correlation of observed spectra to synthetic spectra as a means for discerning astrophysics processes of galaxy evolution.

MISSION SUPPORT

- 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.

**Department of Physics and Astronomy at San Diego State University
8/2012–5/2014**

Graduate Research Assistant

8/2012–5/2014

Worked on computational analysis of Kepler field exoplanetary data. Contributions include several analysis programs to discern systematics of exoplanetary systems (see *Projects*).

Graduate Teaching Associate

8/2012–5/2013

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

**Department of Physics and Astronomy at Michigan State University
9/2008–8/2011**

Research Assistant

4/2009–8/2011

Computational astrophysics: Ran myriad computational simulations on super-computing clusters to further explore astrophysical phenomena. Wrote programs in several programming languages in order to analyze and synthesize data. Presented results in research paper and astronomical conferences.

Teaching Assistant

9/2008–12/2009

Astronomy courses: Performed tasks such as grading, proctoring, hosting/help room sessions, and study sessions.

**Lyman Briggs College at Michigan State University
9/2010–5/2011**

Learning Assistant

9/2010–5/2011

Physics courses: Performed tasks such as grading, proctoring, hosting/help room sessions, conducting study sessions, and setting up and running laboratory experiments.

Publications

PAPERS

Figuring Out Gas and Galaxies in Enzo (FOGGIE). I. Resolving Simulated Circumgalactic Absorption at $2 < z < 2.5$. Peeples, Molly S.; Corlies, Lauren; Tumlinson, Jason; O'Shea, Brian W.; Lehner, Nicolas; O'Meara, John M.; Howk, J. Christopher; **Earl, Nicholas M.**, Smith, Britton D.; Wise, John H.; Hummels, Cameron B. eprint arXiv:1810.06566 (October 2018).

The Astropy Project: Building an Open-science Project and Status of the v2.0 Core Package. Astropy Collaboration, .., **Earl, Nicholas**, et al. The Astronomical Journal, Volume 156, Issue 3, article id. 123, 19 pp. (2018).

Pandemia: a multi-mission exposure time calculator for JWST and WFIRST. Pontoppidan, Klaus M. and Pickering, Timothy E. and Laidler, Victoria G. and Gilbert, Karoline and Sontag, Christopher D. and Slocum, Christine and Sienkiewicz, Mark J. and Hanley, Christopher and **Earl, Nicholas M.** et al. Proc. SPIE 9910, Observatory Operations: Strategies, Processes, and Systems VI, 991016 (July 15, 2016).

PandExo: A Community Tool for Transiting Exoplanet Science with JWST HST. Natasha E. Batalha, Avi Mandell, Klaus Pontoppidan, Kevin B. Stevenson, Nikole K. Lewis, Jason Kalirai, Thomas Greene, Loc Albert,

Louise D. Nielsen, **Nick Earl**. Publications of the Astronomical Society of the Pacific, Volume 129, Number 976 (April 10, 2017).

IN PROGRESS *Diagnosing the CGM: Exploring the CGM through Robust Statistical Comparisons of Observed Absorber Pairs*. **Earl, Nicholas**; Peebles, Molly; Fox, Andrew; Werk, Jessica. Space Telescope Science Institute.

POSTERS

Spectacle and SpecViz: New Spectral Analysis and Visualization Tools. Earl, Nicholas; Peebles, Molly; JDADF Developers. Space Telescope Science Institute.

- Poster presentation and interactive booth demos of software development at the 2018 American Astronomical Society conference in Washington, DC.

SpecViz: Interactive Spectral Data Analysis. Earl, Nicholas. Space Telescope Science Institute

- Poster presentation of research at the 2016 American Astronomical Society conference in San Diego, CA.

Refined Parameters of the Eclipsing Hierarchical Triple Stellar System KOI-126. Earl, Nicholas; Orosz, Jerry; Welsh, William. San Diego State University.

- Poster presentation of research at the 7th annual Student Research Symposium at San Diego State University.
- Poster presentation of research at the 2014 American Astronomical Society conference in Washington D.C.

Dynamic Evolution and Metal Mixing in Supernova Shock Remnants. Earl, Nicholas; O'Shea, Brian; Smith, Britton. Michigan State University Department of Physics and Astronomy.

- Poster presentation of research at the 2011 American Astronomical Society conference in Seattle, WA.
- Poster presentation of research at the 2011 Michigan State University Undergraduate Research Conference in East Lansing, MI.

Grant Activity

- PI. HST Program AR-14560 "Diagnosing the Multiphase Circumgalactic Medium"
- CO-I. HST Program AR-15012 "Resolving the Small-Scale Structure of the Circumgalactic Medium in Cosmological."

Technology Summary

Experienced: Python, C#, C++, C, Rust, FORTRAN, SQL, Unix, Linux, JavaScript, TypeScript, JQuery, Bootstrap, CSS/LESS/Sass, VueJS.

Familiar: React, Ruby, Haskell, Julia, F#, Java, Objective-C, MATLAB, IDL.

Projects

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

DEVELOPER

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.

Pandemia: 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.

Steel: Basic smooth particle hydrodynamics (SPH) code for astrophysical simulations written in Rust, with emphasis on safety, speed, and concurrency.

Pynary: Python code package for light curve detrending, transit locating, and documentation designed for collaborative exoplanetary searches of Kepler MAST data.

Dynamic: Photo-dynamical modeling package for fitting light curves in multi-body systems. The implementation involves reformatted occlusion and robust bayesian ensemble sample 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 ScrumMaster

Skills	<ul style="list-style-type: none"> • Extensive programming experience in several languages (see <i>Technology Summary</i>). • Experience in leading groups on the development, implementation, and release of software products and tools. • Refined abilities in working with groups on research tasks. Creating necessary software, collaborating, and presenting group material. • Experience running courses, in both lecture and laboratory settings. Setting up and providing guidance for laboratory experiments. • Experienced in presenting researched material to large audiences; explaining concepts and ideas in coherent and understandable manner.
Awards	<p>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.</p> <p>STScI Achievement Award: For developing a new generation of python-based spectroscopic visualization tools.</p>
Honors	<p>Ruth and Clifford Smith Astronomy Fellowship</p> <p>Hantel Fellowship Award for Undergraduate Research</p> <p>Dean's List, Michigan State University</p> <p>Honors College, Michigan State University</p>
Outreach	<ul style="list-style-type: none"> • MLO Summer Visitor's Program (SDSU) • STEM Exploration Day (SDSU) • Little Einsteins (SDSU) • Science Sampler (SDSU) • Astronomy Nights on the Roof • Sidewalk Astronomy
Community Service	<ul style="list-style-type: none"> • Member of Sexual-Orientation and Gender Minorities in Astronomy (SGMA) • Member of OUT in Sciences, Tehnology, Engineering, and Mathematics (oSTEM) • The Alliance at Michigan State University
Activities	<ul style="list-style-type: none"> • Python in Astronomy 2018 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