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Department of Physics
University of Washington, Seattle
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Education

University of Washington, Seattle

Ph.D. in Physics, expected May 2025
M.S. in Physics, December 2020
Advisor: Andrew Connolly

Duke University

B.S. in Physics, May 2019
summa cum laude with highest distinction
Advisor: Kate Scholberg

Research Experience

LSST Dark Energy Science Collaboration (DESC) — 2019-present

Leading the high-redshift cosmology analysis using Lyman-break Galaxies (LBGs), including measurements of the UV Luminosity Function, clustering, and cross-correlations with CMB lensing. Also developing the photometric redshift pipeline for DESC cosmology.

The Vera C. Rubin Observatory — 2021-present

Developing and commissioning the active optics system, including leading development of wavefront estimation algorithms, using analytic, forward modeling, and deep learning methods. Member of the galaxy photometry and photometric redshift (photo-z) commissioning teams and the observing support team.

Duke University Neutrino and Cosmology Group — 2016-2019

Simulated core-collapse supernova neutrino bursts. Quantified sensitivity and developed Bayesian analysis methods for the Helium and Lead Observatory (HALO) neutrino detector.

Karlsruhe Institute of Technology — 2018

Studied muon content of cosmic rays detected with the IceTop Array and developed deep learning methods for data analysis (advised by Andreas Haungs).

First-Author Publications

Probabilistic Forward Modeling of Galaxy Catalogs with Normalizing Flows
Crenshaw, J.F., Kalmbach, J.B., Gagliano, A., Yan, Z., Connolly, A.J., Malz, A.I., Schmidt, S.J., LSST Dark Energy Science Collaboration (2024) *AJ*, 168 80. (ADS)

Using AI for Wave-front Estimation with the Rubin Observatory Active Optics System
Crenshaw, J.F., Connolly, A.J., Meyers, J.E., Kalmbach, J.B., Megias Homar, G., Ribeiro, T., Suberlak, K., Thomas, S., Tsai, T. (2024) *AJ*, 167, 86. (ADS)

Learning Spectral Templates for Photometric Redshift Estimation from Broadband Photometry
Crenshaw, J.F. & Connolly, A.J. (2020) *AJ*, 160, 191. (ADS)

Fellowships, Grants, & Awards

NASA Euclid General Investigator Program, Science PI ($480,000)	2025
DOE Cosmic Frontier Grant *contributor* ($360,000)	2023
DOE SCGSR Fellowship ($10,400)	2023
Rubin Observatory ISSC Ambassador ($4,500)	2021-2022
DOE Scholar ($12,000)	2021
Duke Faculty Scholar ($10,000)	2018-2019

	Daphne Chang Memorial Award ($1,000)	2019
	DAAD RISE Research Exchange Fellowship (€5,000)	2018

Invited Talks

DES-DESC Special Session, AAS Winter 2025, National Harbor, MD	Jan 2025
Plenary, Cosmopalooza 2023, online	Oct 2023
Colloquium, University of Chile, Santiago, Chile	Mar 2023
Plenary, AAS Astronomers Turned Data Scientists Meeting, online	Mar 2022
Plenary, DESC Winter Meeting, online	Feb 2022
Seminar, KIPAC, SLAC National Laboratory, online	Sep 2020

Software

PZFlow: Probabilistic modeling of tabular data with normalizing flows
Creator and lead developer. Python package for efficient, high-dimensional joint density estimation and generative modeling of any tabular data. (Github) (PyPI)

PhotErr: Photometric error model for astronomical imaging surveys
Creator and lead developer. Python package for estimating photometric errors for point and extended sources observed in astronomical imaging surveys, including the Rubin, Euclid, and Roman observatories. (Github) (PyPI)

ts-wep: Wave-front estimation for Rubin Observatory Active Optics
Lead developer. Python package for performing wave-front inference on images from the Vera C. Rubin Observatory. I lead development of the wave-front estimation algorithms, including forward modeling and deep learning methodologies. (Github)

RAIL: Redshift Assessment Infrastructure Layers
Contributing developer. Python package for photo-z estimation and evaluation on large scale data. I lead development of the galaxy catalog and systematic error forward modeling framework. (Github) (PyPI)

Leadership & Service

DESC Lyman-break Galaxy Topical Team Leader — 2024-present
Created and leading the Lyman-break Galaxy (LBG) topical team of the Dark Energy Science Collaboration (DESC), focusing on performing precision cosmology with high-redshift galaxies in the range $2 < z < 6$.

Co-chair of the DESC Equity, Diversity, and Inclusion Committee — 2023-present
Leading the Equity, Diversity, and Inclusion (EDI) committee of the Dark Energy Science Collaboration (DESC), including efforts to make DESC resources more accessible to new members, develop EDI guidelines for DESC meetings, and expand safety resources for meeting attendees covering issues such as racism, transphobia, homophobia, access to reproductive care, and mental health.

Rubin Observatory Science Collaborations EDI Committee — 2023-present
Serving as the Dark Energy Science Collaboration (DESC) representative on the Equity, Diversity, and Inclusion committee of the Vera C. Rubin Observatory's council of Science Collaborations.

DUSC Cosmology and Astroparticle Group Leader — 2022-present
Leading the cosmology and astroparticle group meetings of the Dark Universe Science Center (DUSC) at the University of Washington. Duties include setting the agenda, inviting speakers, and organizing events.

Rubin Community Workshop Science Organizing Committee — 2023-2024
Setting the science agenda and inviting speakers for the 2023 and 2024 Rubin Observatory Community Workshops.

DESC Collaboration Meeting Science Organizing Committee 2022-2023
Planned the Winter 2023 meeting of the Dark Energy Science Collaboration (DESC), with a focus on the poster session, events for early career researchers, and the DESC spokesperson election.

AAS Software Carpentry Workshop Volunteer Jan 2023
Assisted instruction in command line and Python programming in the Software Carpentry Workshop at the 241st meeting of the American Astronomical Society, in Seattle, WA.

Physics Undergraduate Reading Course Leadership Committee 2022
Organized reading course for undergraduates, including reviewing student applications, verifying progress during the term, and hosting final presentations.

Physicists for Inclusion and Equity Officer 2020-2021
Lead group in the University of Washington Physics Department, with a focus on providing community and programming for underrepresented groups in physics.

Mentored Students

Dominik Riemann 2022-2024
Developing deep learning methods for the active optics system of the Vera C. Rubin Observatory's Auxiliary Telescope (AuxTel).

Teaching Experience

Reading Course Instructor, University of Washington 2020-2022
Independently designed syllabi and taught advanced reading courses to undergraduates. Courses included *Tensions in ΛCDM Cosmology* and *Gravitational Lensing: From Exoplanets to Large Scale Structure*.

Teaching Assistant, Duke University 2016-2019
Led lab and discussion sections. Lectured on introductory mechanics, fluid dynamics, electromagnetism, and optics.

Undergraduate Tutor, Duke University 2016-2019
Tutored undergraduate students in introductory physics, modern physics, calculus I-II, and linear algebra.

Outreach

Astronomy on Tap: Dark Energy in the era of DESI May 2024
Public talk at a Seattle brewery on Baryon Acoustic Oscillations, the Dark Energy Spectroscopic Instrument (DESI), and theories of Dark Energy.

Astronomy on Tap: Before the Big Bang Apr 2023
Public talk at a Seattle brewery on the CMB, inflation, primordial perturbations, and the potential for an inflationary multiverse.

Outreach at ScioŠkola Praha 11 May 2022
Taught a class of Czech middle school students about Earth's magnetic field, the solar wind, and how the environment of Mars was impacted by the loss of its magnetic field.

Graduate Student Q&A Panel, UC Berkeley Jul 2021
Spoke on panel serving undergraduate students. Discussed aspects of graduate student life and research, with an emphasis on work-life balance, and navigating academic spaces as a queer person.

STEM Pals Organizer & Pedagogical Simulation Lead 2021
Helped launch a STEM outreach program at the University of Washington. Designed interactive simulations to teach high school students how simulations allow researchers to study complex systems.

	Duke University Teaching Observatory Held star parties for members of the public, using telescopes to observe nebulae, star clusters, and planets.	2018-2019
	Queer in Research Discussion Panel Spoke on panel discussing experiences as a queer person in STEM. Gave advice on how to find queer-friendly research groups and how to build queer support systems in a professional context.	Oct 2018
	Public Lecture: Where Did We Come From and Are We Alone – Cosmic Origins and the Search for Life Public lecture for undergraduates at Duke University explaining the standard model of cosmology, the search for life in the solar system and on exoplanets.	Jan 2018
Contributed Talks	DESC Summer Meeting, Chicago, IL	Aug 2022
	DESC Winter Meeting, online	Feb 2022
	Rubin Observatory Project & Community Workshop, online	Aug 2020
	DESC Winter Meeting, Tucson, AZ	Jan 2020
Posters	Rubin Observatory Community Workshop, Palo Alto, CA	Jul 2024
	American Astronomical Society 241st Meeting, Seattle, WA	Jan 2023
	American Astronomical Society 238th Meeting, online	Jun 2021
	Statistical Challenges in Modern Astronomy VII, online	Jun 2021
	Duke Physics Research Symposium, Durham, NC	Apr 2019
	5th Joint Meeting of the American Physical Society and the Physical Society of Japan, Waikoloa, HI	Oct 2018
	28th International Conference on Neutrino Physics and Astrophysics, Heidelberg, Germany	Jun 2018

Publication List

First-Author Publications

4. Quantifying the Impact of LSST *u*-band Survey Strategy on Photometric Redshift Estimation and the Detection of Lyman-break Galaxies
Crenshaw J. F., Leistedt B., Graham M. L., Payerne C., Connolly A. J., Gawiser E., Karim T., Malz A. I., Newman J. A., Ricci M., LSST Dark Energy Science Collaboration (*in collaboration review*)

3. Probabilistic Forward Modeling of Galaxy Catalogs with Normalizing Flows
Crenshaw J. F., Kalmbach J. B., Gagliano A., Yan Z., Connolly A. J., Malz A. I., Schmidt S. J., LSST Dark Energy Science Collaboration (2024) *AJ*, 168 80. (ADS)

2. Using AI for Wave-front Estimation with the Rubin Observatory Active Optics System
Crenshaw, J. F., Connolly A. J., Meyers J. E., Kalmbach J. B., Megias Homar G., Ribeiro T., Suberlak K., Thomas S., Tsai T. (2024) *AJ*, 167, 86. (ADS)

1. Learning Spectral Templates for Photometric Redshift Estimation from Broadband Photometry
Crenshaw J.F. & Connolly A.J. (2020) *AJ*, 160, 191. (ADS)

Co-Author Publications

7. Impact of survey spatial variability on galaxy redshift distributions and the cosmological 3×2-point statistics for the Rubin Legacy Survey of Space and Time (LSST)
Hang Q., Joachimi B., Charles E., **Crenshaw J. F.**, Larsen P., Malz A. I., Schmidt S., Yan Z., Zhang T. (2024) *MNRAS*, 535, 4. (ADS)

6. The Active Optics System on the Vera C. Rubin Observatory: Optimal Control of Degeneracy Among the Large Number of Degrees of Freedom
Megias Homar G., Kahn S. M., Meyers J. M., **Crenshaw J. F.**, Thomas S. J. (2024) *ApJ*, 74, 108. (ADS)

5. Improving Photometric Redshift Estimates with Training Sample Augmentation
Moskowitz I, Gawiser E., **Crenshaw J. F.**, Andrews B. H., Malz A. I., Schmidt S., LSST Dark Energy Science Collaboration (2024) *ApJL*, 967. (ADS)

4. Rubin Observatory Simonyi Survey Telescope Active Optics
Thomas S., Connolly A. J., **Crenshaw J. F.**, Kalmbach J. B., Megias Homar G., Meyers J. E., Ribeiro T., Tsai T., Claver C., Neill D., Braga V. F., Fiorentino G., Savarese S., Schipani P., Schreiber L., Di Criscienzo M. (2023) *AO4ELT*, 7, 67. (ADS)

3. The Simulated Catalogue of Optical Transients and Correlated Hosts (SCOTCH)
Lokken M., Gagliano A., Narayan G., Hložek R., Kessler R., **Crenshaw J. F.**, Salo L., Alves C. S., Chatterjee D., Vincenzi M., Malz A. (2023) *MNRAS*, 520, 2. (ADS)

2. The Sensitivity of GPz Estimates of Photo-z Posterior PDFs to Realistically Complex Training Set Imperfections
Stylianou N., Malz A., Hatfield P., **Crenshaw J. F.**, Gschwend J. (2022) *PASP*, 134, 1034. (ADS)

1. An information-based metric for observing strategy optimization, demonstrated in the context of photometric redshifts with applications to cosmology
   Malz A. I., Lanusse F., **Crenshaw J. F.**, Graham M. L. (2021) *arXiv.* (ADS)