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John Franklin Crenshaw

Email: jfc20@uw.edu
Web: https://jfcrenshaw.github.io
ORCID: 0000-0002-2495-3514

Department of Physics
University of Washington, Seattle
Seattle, WA

Education

University of Washington, Seattle

Ph.D. in Physics, expected June 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).

Fellowships & Awards

DOE SCGSR Fellowship	2023
AAS Chambliss Astronomy Achievement Award Honorable Mention	2023
Rubin Observatory ISSC Ambassador	2021-2022
DOE Scholar	2021
NSF Graduate Research Fellowship Honorable Mention	2021
Duke Faculty Scholar	2018-2019
Daphne Chang Memorial Award, Duke Physics Department	2019
Highest Distinction for Undergraduate Thesis Research	2019
DAAD RISE Research Exchange Fellowship	2018

Invited Talks

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

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

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)

Observing Experience

Rubin Observatory AuxTel - 4 nights
Apache Point Observatory ARC 3.5m - 3 nights

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 Volunteer — 2018-2019
Held star parties for members of the public, where we used telescopes to observe binary stars, star clusters, planets, etc.

Queer in Research Discussion Panel — Oct 2018
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.

Public Lecture: Where Did We Come From and Are We Alone – Cosmic Origins and the Search for Life — Jan 2018
Public lecture for undergraduates at Duke University, explaining the standard model of cosmology, the search for life in the solar system and on exoplanets.

Service & Leadership

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 $2 < z < 6$.

DESC Equity, Diversity, and Inclusion Committee — 2023-present
Serving on the Equity, Diversity, and Inclusion (EDI) committee of the Dark Energy Science Collaboration (DESC), leading 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.

University of Washington Astronomy Journal Club 2023-present

Leading the weekly journal club of the University of Washington Astronomy Department.

Rubin Community Workshop Science Organizing Committee 2023-2024

Setting the science agenda and inviting speakers for the 2023 and 2024 Rubin Observatory Community Workshops.

DiRAC Machine Learning Group Leader 2022-2023

Leading the machine learning group of the DiRAC institute at the University of Washington. Duties include setting the agenda and inviting speakers.

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.

University of Washington Academic Grievance Committee 2022

Served on a committee including faculty and deans, adjudicating academic grievance cases brought forward by graduate students.

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.

Photo-z Commissioning Session Organizer Aug 2022

Organized the Photo-z Commissioning Session at the 2022 Rubin Observatory Project and Community Workshop in Tucson, AZ. Work included planning the session, inviting speakers, and facilitating group discussion.

Snowmass 2021 Summer Study A/V Co-coordinator Jul 2022

Coordinated audio/visual equipment for the hyrbrid Snowmass 2021 Summer Study in Seattle, Washington. Work included determining needs, securing and setting up equipment, and training volunteers how to use the equipment.

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.

Publication List

First-Author Publications

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

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* (in press). (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)

Conferences & Workshops

Conferences	KIPAC@20, Palo Alto, CA	Sep 2023
	241st Meeting of the American Astronomical Society, Seattle, WA	Jan 2023
	4th Annual Astronomers Turned Data Scientists Meeting	Mar 2022
	238th Meeting of the American Astronomical Society, online	Jun 2021
	Statistical Challenges in Modern Astronomy VII, online	June 2021
	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
Workshops	Rubin Observatory Active Optics Commissioning Readiness Review Workshop, online	May 2024
	Dark Energy Science Collaboration (DESC) RAIL Retreat, Palo Alto, CA	July 2023
	LSSTC Data Science Fellowship Workshop: Image Processing for Wide Field Surveys, Seattle, WA	Jun 2023
	Michigan Summer Cosmology School 2023, Ann Arbor, MI	Jun 2023
	Astronomical Software Development Workshop, Center for Computational Astrophysics, New York City, NY	May 2022
	Summer School in Statistics for Astronomers 2021, online	Jun 2021
Collab. Meetings	2024 Rubin Observatory Project & Community Workshop, Palo Alto, CA	Jul 2024
	July 2024 Meeting of the Dark Energy Science Collaboration, Zurich, Switzerland	Jul 2024
	February 2024 Meeting of the Dark Energy Science Collaboration, online	Feb 2024
	2023 Rubin Observatory Project & Community Workshop, Tucson, AZ	Aug 2023
	July 2023 Meeting of the Dark Energy Science Collaboration, Palo Alto, CA	Jul 2023
	Rubin Observatory Active Optics Workshop, hydrid	May 2023
	2023 Rubin Observatory Joint Technical Meeting, La Serena, Chile	Mar 2023
	2022 Rubin Observatory Project & Community Workshop, Tucson, AZ	Aug 2022
	August 2022 Meeting of the Dark Energy Science Collaboration, Chicago, IL	Aug 2022
	February 2022 Meeting of the Dark Energy Science Collaboration, online	Feb 2022
	2021 Rubin Observatory Project & Community Workshop, online	Aug 2021
	Dark Energy Science Collaboration Sprint Week 2021, online	Oct 2021
	July 2021 Meeting of the Dark Energy Science Collaboration, online	Jul 2021
	February 2021 Meeting of the Dark Energy Science Collaboration, online	Feb 2021
	Dark Energy Science Collaboration Sprint Week 2020, online	Dec 2020
	2020 Rubin Observatory Project & Community Workshop, online	Aug 2020
	July 2020 Meeting of the Dark Energy Science Collaboration, online	Jul 2021
	January 2020 Meeting of the Dark Energy Science Collaboration, online	Jan 2020