Rosalia O'Brien

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SUMMARY

- Research Interests: Observational extragalactic astronomy & cosmology, Extragalactic Background Light, Cosmic Optical Background, Foreground modeling, Zodiacal Light, Diffuse Galactic Light, Image processing and calibration (Hubble Space Telescope, James Webb Space Telescope)
- Hubble Space Telescope processing and reduction expert
- 3 first author papers (AJ, ApJS)
- 17 co-author papers
- Presented 9 talks and 4 posters
- Passionate about science communication, teaching, and mentoring: Extensive outreach experience; Various awards for talks and posters; Led research-based class; Mentored 5+ students

EDUCATION

Astrophysics Ph.D. *2020–2025*
Arizona State University
Advisor: Prof. Rogier Windhorst, Dr. Rolf Jansen

Physics B.S. - Astronomy minor, Mathematics minor *2016–2020*
Texas A&M University

RESEARCH EXPERIENCE

SKYSURF-IR: Constrain Zodiacal Light & diffuse Extragalactic Background Light from Archival JWST images *2024–Present*
Arizona State University
- PI: Prof. Rogier Windhorst
- Will model Zodiacal light emission optimized for JWST, based on the SKYSURF model
- Will implement SKYSURF diffuse Galactic light model

JWST PEARLS: Prime Extragalactic Areas for Reionization and Lensing Science *2022–Present*
Arizona State University
- PI: Prof. Rogier Windhorst
- Measured sky surface brightness in JWST GTO observations

SKYSURF: Constraints on Zodiacal Light and Extragalactic Background Light through Panchromatic HST All-sky Surface-brightness Measurements *2020–Present*
Arizona State University
- PI: Prof. Rogier Windhorst
- Wrote and tested Python scripts to accurately measure the sky background level in any Hubble Space Telescope (HST) image to within a 1% error
- Ran sky estimation algorithms on over 200,000 HST images
- Explored how HST systematics might affect sky measurements, including Wide Field Camera 3 (WFC3) and Advanced Camera for Surveys (ACS) amplifier differences, WFC3 chip differences, sky gradients, total object brightness, and more
- Mentored various undergraduate students in independent projects
- Created website to host SKYSURF project using HTML
- Published paper on SKYSURF sky measurements

- Used sky measurements to create a refined three-dimensional model of zodiacal light by refining the scattering phase function and albedo of the Kelsall et al. 1998 model
- Published paper of SKYSURF zodiacal light model

TREASUREHUNT: Hubble's UV-Visible treasury imaging of the JWST NEP TDF *2021–Present*
Arizona State University
- Advisor: Dr. Rolf Jansen
- Wrote pipeline to remove bad pixel columns and satellite trails from HST images
- Combined (drizzled) HST images using Python programs (TweakReg and AstroDrizzle) that showed ∼50% improvements in noise levels compared to standard pipeline products
- Wrote pipeline to align drizzled images to the Gaia DR3 reference frame, with a scatter within 0.01 arcseconds
- Created mosaics using AstroDrizzle
- Identified transients and galaxies with variability, and published paper with results

Reducing Drift and Shift (DASH) Data *2019*
Space Telescope Science Institute
- Advisor: Catherine Martlin
- Wrote generalized pipeline for data taken with the WFC3 instrument on HST using the DASH observing mode (DASH is an observing mode that specializes in reducing HST's minimum observing time by no longer using the Fine Guidance Sensors to lock onto a target during an exposure, resulting in smeared output images that need to be unsmeared)
- Wrote walk-through of pipeline using Jupyter Notebook
- Tracked pipeline/ software updates using Git/ Github

CLEAR: CANDELS Lyman-α Emission At Reionization Survey *2018–2021*
Texas A&M University
- Advisor: Prof. Casey Papovich
- Created website (https://clear.physics.tamu.edu) using HTML that displays data and results from the CLEAR Survey in a series of interactive Leaflet maps
- Used GALFIT to determine color gradients of 90 CLEAR galaxies and explored how these color gradients depended on redshift, lookback time, and mass

FIRST-AUTHOR PUBLICATIONS

SKYSURF-11: A New Zodiacal Light Model Optimized for Optical Wavelengths
O'Brien, R., Arendt, R. G., Windhorst, R. A. et al. 2025, arXiv:2510.18231

TREASUREHUNT: Transients and Variability Discovered with HST in the JWST North Ecliptic Pole Time Domain Field
O'Brien, R., Jansen, R. A., Grogin, N. A. et al. 2024, ApJ, 272, 19

SKYSURF-4: Panchromatic HST Full Sky Surface Brightness Measurement Methods and Results
O'Brien, R., Carleton, T., Windhorst, R. A. et al. 2023, AJ, 165 237

CO-AUTHOR PUBLICATIONS

SKYSURF. VIII. Modeling SKYSURF Completeness Data for Comparison to the Hubble Space Telescope Exposure Time Calculator
Goisman, Zachary and 7 colleagues including **O'Brien, R.** 2025, PASP, 137, 094501

SKYSURF-10: A Novel Method for Measuring Integrated Galaxy Light
Carter, Delondrae D. and 21 colleagues including **O'Brien, R.** 2025, 10.48550/arXiv.2507.05323

SKYSURF IX – The Cosmic Optical and Infrared Background from Integrated Galaxy Light Measurements
Tompkins, Scott A. and 18 colleagues including **O'Brien, R.** 2025, 10.48550/arXiv.2507.03412

PEARLS: Twenty-One Transients Found in the Three-Epoch NIRCam Observations in the Continuous Viewing Zone of the James Webb Space Telescope
Yan, Haojing and 42 colleagues including **O'Brien, R.** 2025, 10.48550/arXiv.2506.12175

Lonely Little Red Dots: Challenges to the AGN-nature of little red dots through their clustering and spectral energy distributions
de las Mercedes Carranza Escudero, Maria and 33 colleagues including **O'Brien, R.** 2025, AJ, 989, L50

Stellar Populations and Molecular Gas Composition in the Low-Metallicity Environment of WLM
Archer, H. N. and 10 colleagues including **O'Brien, R.** 2025, AJ, 169, 301

SKYSURF-7: Exploring PSF Contamination in Diffuse Sky Measurements with HST
Conrad, L., **O'Brien, R.**, et al. 2025, Research Notes of the AAS, 9, 3

The Tale of Two Telescopes: How Hubble Uniquely Complements the James Webb Space Telescope: Galaxies
Windhorst, R. A. and 12 colleagues including **O'Brien, R** 2024, eprint arXiv:2410.01187

PEARLS: Discovery of Point-source Features within Galaxies in the North Ecliptic Pole Time Domain Field
Ortiz, R. and 38 colleagues including **O'Brien, R.** 2024, ApJ, 974, 258

SKYSURF-5: Probing the Integrated Galaxy Light with a SDSS-SKYSURF Cross-matched Catalog
Bhatia, P., Carleton, T, Windhorst, R. A., Jansen, R. A. and **O'Brien, R** 2024, Research Notes of the American Astronomical Society, 8, 154

PEARLS: NuSTAR and XMM-Newton Extragalactic Survey of the JWST North Ecliptic Pole Time-domain Field II
Zhao, X. and 34 colleagues includes **O'Brien, R.** 2024, ApJ, 965, 188

SKYSURF VI: The Impact of Thermal Variations of HST on Background Light Estimates
McIntyre, I. A., Carleton, T., **O'Brien, R.**, et al. 2024, AJ, 169, 136

SKYSURF: Constraints on Zodiacal Light and Extragalactic Background Light through Panchromatic HST All-Sky Surface-Brightness Measurements: I. Survey Overview and Methods
Windhorst, R.A., Carleton, T., **O'Brien, R.** et al. 2022, AJ, 164, 4

SKYSURF: Constraints on Zodiacal Light and Extragalactic Background Light through Panchromatic HST All-Sky Surface-Brightness Measurements: II. First Limits on Diffuse Light at 1.25, 1.4, and 1.6 microns
Carleton, T., Windhorst, R. A., **O'Brien, R.**, et al. 2022, AJ, 164 170

Reducing Drift and Shift (DASH) Data Using wfc3_dash and Accompanying Notebook Workflow
Martlin, C., **O'Brien, R.**, Momcheva, I. et al 2021, WFC3 Instrument Science Report

JWST PEARLS. Prime Extragalactic Areas for Reionization and Lensing Science: Project Overview and First Results
Windhorst, R. A., Cohen, S., Jansen, R. A., Summers, J., Tompkins, S., Conselice, C., Driver, S., Yan, H., Coe., D., Frye, B., Grogin, N., Koekemoer, A., Marshall, M., **O'Brien, R.** et al. 2022, AJ, 165, 13

CLEAR: Survey Overview, Data Analysis and Products
Simons, R. C.and 21 colleagues including **O'Brien, R.**, 2023, ApJS, 266, 13

PRESENTATIONS

The Faint and Diffuse Optical/Infrared Sky: Constraining the EBL and the Bright Foregrounds that Obscure It (30min Talk; Virtual) *2026*
Clemson

The Faint and Diffuse Optical/Infrared Sky: Constraining the EBL and the Bright Foregrounds that Obscure It (30min Talk; In person) *2026*
University of Virginia Origins Colloquium

SKYSURF: Unveiling the Cosmic Optical Background and Zodiacal Light with Hubble (1hr Talk; In person) *2025*
Caltech ObsCos Seminar

A New 3D Zodiacal Light Model Optimized for Optical Wavelengths (Poster) *2025*
245th Meeting of the American Astronomical Society

SKYSURF: Unveiling the Cosmic Optical Background and Zodiacal Light with Hubble (20min Talk; Virtual) *2024*
STScI Journal Club

SKYSURF: Unveiling the Cosmic Optical Background and Zodiacal Light with Hubble (Keynote) *2024*
SESE Internal Symposium

SKYSURF: Constraints on Zodiacal Light and Extragalactic Background Light through Panchromatic Hubble All-sky Surface-brightness Measurements (20min Talk) *2024*
Diffuse Backgrounds and the Low Surface Brightness Universe Conference

TREASUREHUNT: Transients and Variability Discovered with the Hubble Space Telescope in the JWST North Ecliptic Pole Time Domain Field (Poster) *2024*
243rd Meeting of the American Astronomical Society

Science with the Hubble Space Telescope and the James Webb Space Telescope at ASU (Short Talk) *2023*
ASU Online Astronomy Class

SKYSURF-4: Panchromatic Full Sky Surface Brightness Measurement Methods and Results (Poster) *2023*
241st Meeting of the American Astronomical Society

SKYSURF: Preliminary 0.2-1.7 μm Sky Surface Brightness Measurements with Hubble (Poster) *2022*
240th Meeting of the American Astronomical Society

JWST: Entering a New era of Astronomy (Talk) *2022*
Sundial No Jargon Conference

Is there too much light in our universe? Observing the extragalactic background with the Hubble Space Telescope (1hr Talk) *2022*
Minnesota State University, Mankato

New Discoveries Lecture Series: "The Universe Beyond Hubble" (Panel Discussion) *2021*
Arizona State University

WFC3 DASH Reduction Pipeline Development and Launch (Poster) *2020*
235th Meeting of the American Astronomical Society

WFC3 DASH Reduction Pipeline Development and Launch (20min Talk) *2020*
Texas Astronomy Undergraduate Research Symposium (TAURS)

WFC3 DASH Reduction Pipeline Development and Launch (20min Talk) *2019*
Space Telescope Science Institute Space Astronomy Summer Program (STScI SASP)

CLEAR Website Update (Short talk) *2019*
Space Telescope Science Institute Space Astronomy Summer Program (STScI SASP)

MENTORING & TEACHING EXPERIENCE

Teaching Assistant *Spring 2025*
Arizona State University
- Led lab for "Introduction to Astronomy" class
- 3 classes per week, 70 students total
- Each week: Create and lead 20min lecture, lead astronomy lab (telescope use, worksheets), grade lab assignments, communicate with students outside of class via email, and manage class websites

Lecturer for Research-based Class *Fall 2023*
Arizona State University
- Volunteered to lead research-based class where ∼15 students measured the sky surface brightness using Python scripts that I developed
- Led 30 minute lectures weekly
- Actively answered questions outside of class (via Slack or Zoom)
- The students in the class successfully ran code on over 30,000 HST images

Adisor/ Mentor for Student Research Projects *2021—Present*
Arizona State University
- Brenden Brinkman - Comparing Different Percentiles used in SKYSURF Sky-SB Measurement Algorithms
- Megan Miller - Obtaining panchromatic HST zodiacal light and diffuse galactic light measurements
- Hal Ingram - Sky-SB measurements on WFPC2
- Charles Jeffries - Using Machine Learning to locate images that are unreliable for SKYSURF sky-SB measurements
- Logan Conrad - **Published AAS Research Note** (SKYSURF-7: Exploring PSF Contamination in Diffuse Sky Measurements with HST)
- Tejovrash Acharya - ZodiPy

School of Earth and Space Exploration Peer Mentor *2021—2022*
Arizona State University

Sundial Mentoring Program *2021-Present*
Arizona State University
- Helped underrepresented freshmen science students transition to higher education by holding weekly meetings to chat, answer questions, and discuss possible research projects.
- Presented "No Jargon" talks on research every semester
- Helped organize outreach events for the group including SESE Open House
- Helped develop science demos, including a demonstration showcasing how Global Warming might affect the world's cities

Designed Classes for Prison Education Program *2022–Present*
Arizona State University
- Designed lessons at local adults prisons and juvenile prisons, with plan to teach by Summer 2023

- Helped finalize online curriculum for local juvenile prison

SERVICE

Reviewer for Publications of the Astronomical Society of Japan (PASJ) *2024*
Remote

Sci Comm Videos *2021-Present*
Youtube
- A Space Telescope Love Story
- Overview of Primordial Non-gaussianity from Large-scale structure (SPHEREx)

Outreach Leader for Windhorst Cosmology Group *2022–Present*
Arizona State University
- Led outreach involvement for my research group
- Recruited volunteers and organized booths at many annual events, such as ASU Open Door, SESE Open House, ESE Day, The Fountain Hills Dark Sky Festival, and ASU Homecoming Block Party
- Implemented new extragalactic astronomy and cosmology demonstrations, including a 3D printed model of the VV-191 galaxy pair for persons with visual impairments,

Letters to a Pre-scientist Program *Fall 2023 - Spring 2024*
Remote
- Wrote letters to middle school pen pal about life as a scientist

Meeting with Undergraduate Physics Class *Fall 2023*
Arizona State University
- Chatted about being a graduate student with undergraduate students over lunch

Panel Discussion During Undergraduate Class *Fall 2023*
Arizona State University
- Chatted about being a graduate student during 2 classes

Earth & Space Expedition Center Volunteer *2023–2024*
Phoenix, Arizona

ASU Graduate Professional Association Grant Reviewer *2023–2024*
Arizona State University
- Reviewed up to 10 grant applications per month

Leader for SESE Summer Extragalactic Seminar Graduate Student Talks *2021-2024*
Arizona State University
- Invited presenters to give virtual talks at ASU
- Hosted graduate student meetings with visiting professors

Arizona Science and Engineering Fair *2023*
Phoenix Convention Center
- Judged 10 elementary/ junior level science projects under the Physics and Astronomy subject, then picked winners
- The Arizona Science and Engineering Fair is a state fair that brings together first place winners from school, homeschool, district, county, and regional science fairs

Judge for Broadmor Elementary Science Fair *2023*
Broadmor Elementary School
- Judged three elementary school student science projects
- Left positive comments for each student

Space Colony Competition Judge *2022–2024*
Virtual
- Judge 2 to 4 teams for the Annual Space Colony Competition, with participants from around the US
- 2023 Award Ceremony
- 2022 Award Ceremony

Graduate Student Panel Discussion *2022*
Arizona State University
- Participated in 2 panel discussions where I answered questions about my experience as a graduate student

Annual Physics and Engineering Festival *2016-2019*
Texas A&M University
- Developed and presented Physics demonstration (magnetic slime) during the annual festival, with as many as 6,000 attendees

Physics Demos *2016-2020*
Texas A&M University and Tarleton State University
- Presented physics demos at several events, including Football Game Day Physics, Aggieland Saturday, and the American Association of Physics Teachers (AAPT) Conference
- Encouraged excitement for science for people of all ages

Undergraduate Teaching Fellow *2018*
Texas A&M University
- Tutored students (about 5 students, once per week) in introductory physics courses

SKILLS

Expert in data reduction and analysis of Hubble Space Telescope images. Experience with data reduction and analysis of James Webb Space Telescope images.

Data Analysis, Programming Languages, and Tools:
- **Python 3: Advanced**
- Version Control: Proficient in Git and GitHub for code management and collaboration
- Astronomy Data Analysis Software: Experienced in using HEALpix, TweakReg, AstroDrizzle, GALFIT, SourceExtractor, SEP (SourceExtractor for Python), Photutils, Astropy, ds9, gunagala, and emcee
- IDL: Competent

Data Management:
- Large Dataset Management: Capable of managing and analyzing large datasets (+200,000 images) efficiently.
- Large Collaboration Management: Experienced in coordinating and managing projects with large, international teams.

Science Communication:
- Extensive experience in communicating astronomy effectively, both to the general public (e.g., Outreach Leader for Windhorst Cosmology Group, various Youtube videos), and experts in the field (e.g., Martin and Beate Block Winter Award, various technical presentations)
- Teaching experience (class design, creating and leading lectures, managing large classes (70+ students, grading)
- LaTeX: Advanced

- Experience writing HST, JWST, NSF and NASA proposals

Web Development:
- HTML, CSS, and Javascript: Experience in creating interactive web content, including experience with Leaflet for interactive mapping.

AWARDS & SCHOLARSHIPS

- HST Cycle 32 TREASURETROVE (28 orbits; Co-I)
- JWST Cycle 3 Archival Project DARK-SKY (Co-I; Funded for $\sim$ 1 year as a graduate student)
- HST Cycle 27 Archival Project SKY-SURF (Co-I; Funded for $\sim$ 2 years as a graduate student)

Graduate Awards:
- 2025 Vivian Forde Graduate Fellowship - $10,000
- ASU 2024 Student Leader Nominee
- Martin and Beate Block Winter Award - *$1,000*
- 2024 ASU GPSA Travel Grant - *$950*
- ASU 2023 Student Leader Nominee
- ASU GPSA Service Award - *$750*
- 2022 ASU GPSA Travel Grant - *$950*
- 240th AAS Meeting Chambliss Astronomy Achievement Student Award
- 2022 AAS FAMOUS Grant - *$1,000*
- 2021-2022 Graduate Excellence Award - *$100*

Undergradute Awards:
- Cynthia Woods Mitchell Undergraduate Scholarship for Women in Physics Fund - *$1,000*
- Randall C. Shepard '71 Scholarship - *$2,000*
- College Board Recognition Scholarship - *$14,000*
- Phillip and Doris Moses Ranch Fund Scholarship - *$3,000*
- Scholarship America Scholarship - *$5,000*
- Phi Eta Sigma Honor Society

PRESS

ASU News - Hubble detects faint 'ghost light' around our solar system with SKYSURF

NASA Hubblesite - Hubble Detects Ghostly Glow Surrounding Our Solar System

ASU News - Webb telescope PEARLS project unveils exquisite views of distant galaxies

STScI Webb Telescope - Webb Glimpses Field of Extragalactic PEARLS, Studded With Galactic Diamonds

CNN - Dazzling galactic diamonds shine in new Webb telescope image

CONTRIBUTED PRESENTATIONS

The JWST North Ecliptic Pole Time Domain Field (NEP-TDF): Results based on Multi-wavelength Observations, including HST and JWST Data
Nimish Hathi, Rolf A. Jansen, **Rosalia O'Brien**, et al. 2025, American Astronomical Meeting #245

The JWST North Ecliptic Pole Time Domain Field: Results from HST, JWST, Chandra, and NuSTAR
Rolf A. Jansen, R. O'Brien, N. Grogin, et. al., 2024, American Astronomical Society Meeting #244

UV-near-IR observations with JWST and HST in the JWST North Ecliptic Pole Time-Domain Field
Jansen, R., Windhorst, R., Summers, J., **O'Brien, R.**, Grogin, N., Willmer, C., Conselice, C., Koekemoer, A., PEARLS Team, TREASUREHUNT Team, 2023, American Astronomical Society Meeting #241

JWST's PEARLS: Prime Extragalactic Areas for Reionization and Lensing Science: Project Overview and First Results
Windhorst, R., Cohen, S., Jansen, R., and and 15 colleagues including **O'Brien, R.**, 2023 American Astronomical Society Meeting #241