Rosalia O'Brien

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RESEARCH INTERESTS

Observational extragalactic astronomy & cosmology, Extragalactic Background Light, Cosmic Optical Background, Zodiacal Light, Sky Surface Brightness, Image processing and calibration (Hubble Space Telescope, James Webb Space Telescope)

EDUCATION

Astrophysics Ph.D. *2020–Present*
Arizona State University

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

RESEARCH EXPERIENCE

JWST PEARLS: Prime Extragalactic Areas for Reionization and Lensing Science *2022–Present*
Arizona State University
- Advisor: Prof. Rogier Windhorst
- Measured sky surface brightness in PEARLS GTO observations of the James Webb Space Telescope

SKYSURF: Constraints on Zodiacal Light and Extragalactic Background Light through Panchromatic HST All-sky Surface-brightness Measurements *2020–Present*
Arizona State University
- Advisor: 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 undergradute students in independent projects
- Created website to host SKYSURF project using HTML
- Published paper on SKYSURF sky measurements

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 significant improvements 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
- Found transients (e.g. supernovae) in observations, with plans to lead a research paper on 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

PUBLICATIONS

SKYSURF-4: Panchromatic HST Full Sky Surface Brightness Measurement Methods and Results
O'Brien, R. and Carleton, T. and Windhorst, R. A. et al. 2023, arXiv e-prints, arXiv:2210.08010

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, arXiv e-prints, arXiv:2205.06347.

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, arXiv e-prints, arXiv:2209.04119

CLEAR: Survey Overview, Data Analysis and Products
Simons, Raymond C., Papovich, Casey, Momcheva, Ivelina G., and 19 colleagues including **O'Brien, R.** 2023, arXiv e-prints, arXiv:2303.09570

PRESENTATIONS

Science with the Hubble Space Telescope and the James Webb Space Telescope at ASU (Invited 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 (Keynote) *2022*
Sundial No Jargon Conference

Is there too much light in our universe? Observing the extragalactic background with the Hubble Space Telescope (Invited 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 (Keynote) *2020*
Texas Astronomy Undergraduate Research Symposium (TAURS)

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

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

CONTRIBUTED PRESENTATIONS

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, 2023AAS...24120705J

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, 2023AAS...24114303W

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

SERVICE & TEACHING EXPERIENCE

Chat with PHY 191 Class *Fall 2023*
Arizona State University
- Chatted about being a graduate student with undergraduate students over lunch

SES 191 Panel Discussion *Fall 2023*

Arizona State University
- Chatted about being a graduate student during 2 classes

SESE Peer Mentor *2021—2022*
Arizona State University

Mentored Independent 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

Led Research Project for SES 394 Class *Fall 2023*
Arizona State University
- Led research project where students measured the sky surface brightness using SKYSURF Python scripts that I developed (see SKYSURF github)
- Attended class weekly and led $\tilde{3}0$ minute presentations on the project
- Actively answered questions outside of class (via Slack or Zoom)
- Class successfully ran code on over 30,000 HST images spanning all of WFPC2s filters

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

ASU GPSA Grant Reviewer *2023–Present*
Arizona State University
- Reviewed up to 10 grant applications per month

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

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

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

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

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–Present*
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

- Python 3, Github/ Git, Jupyter Notebook, Pandas
- TweakReg, AstroDrizzle, GALFIT, SourceExtractor, SEP, Photutils, Astropy, gunagala
- HTML: Includes experience with Leaflet (a Javascript library for creating interactive maps), CSS, and Javascript
- Latex

AWARDS & SCHOLARSHIPS

- ASU 2023 Student Leader Nominee
- ASU GPSA Service Award - *$750*
- ASU GPSA Travel Grant - *$950*
- 240th AAS Meeting Chambliss Astronomy Achievement Student Award
- AAS FAMOUS Grant - *$1,000*
- 2021-2022 Graduate Excellence Award - *$100*
- 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