

# SEAN MACBRIDE

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## EDUCATION

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**University of Zürich, Zürich, Switzerland**  
Ph.D. in Physics

May 2024 - Present

**University of Michigan, Ann Arbor Michigan**  
M.Sc. in Physics

Aug 2022 - May 2024

**Wheaton College, Norton Massachusetts**  
B.A. in Physics, Honors. Minor in Astronomy

Aug 2016 - May 2020

## RESEARCH

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**University of Zürich/University of Michigan**  
Graduate Student Research Assistant

Apr 2023 - Present

Prof. Marcelle Soares-Santos

- **Dark Energy Survey:** Implemented improvements to Dark Energy Survey gravitational wave (DESGW) pipeline, including improvements to the telescope strategy and real-time monitoring code. Performed remote observing using the Dark Energy Camera (DECAM) in response to gravitational wave (GW) triggers S240413p and S240915b. Performed analysis of DECAM observations of GW events S240413p, S240422ed, S240511i, and S240915b.
- **Rubin Observatory:** Led re-verification of LSST Camera (LSSTCam) on Cerro-Pachón. Characterized defects in LSSTCam, including the picture-frame response in different detector types. Contributed to commissioning telescope mount assembly. Contributed to Target-of-Opportunity strategy development for GW, neutrino, and solar system object events.
- **Dark Energy Spectroscopic Instrument:** Tested DESI robotic positioners to increase precision and improve testing capabilities for DESI focal plane. Characterized failure mode of DESI positioners and resolved failure with a reproducible solution. Authored and submitted an internal report and presented the results of this study to the DESI focal plane working group.
- **Spec-S5:** Designed a new testing apparatus for detectors for astronomical applications using vacuum, thermal, and optical subsystems. Dynamic testing of robotic positioner performance through lifetime, focal-ratio degradation, and fiber angle tests in different telescope configurations.

**University of Michigan**  
Graduate Student Research Assistant

Jan 2023 - Apr 2023

Prof. Keith Riles

- Wrote code to model gravitational-wave ringdown signal of neutron star binary merger.
- Developed detection statistic for measuring if the model template is properly detecting injected gravitational wave signal.
- Tested different signal models to ensure robustness of detection statistics under different model conditions.

**University of Michigan & Southwest Research Institute**

Feb 2023

Graduate Observer - NASA LUCY

Prof. David Gerdes (UM) &amp; Marc Buie (SwRI)

- Participated in a ground-based observation campaign to study the occultation of the Jupiter trojan asteroid 15094 Polymele. Authored procedure used by 50+ team members, detailing process to configure Celestron telescope mount, optics, and software in efficient manner.
- Coordinated 1,100+ miles of travel to observation site location. Trained other team members in telescope setup and resolved issues with hardware and software in preparation for occultation event.
- Successfully captured field of observation during occultation event. Contributed data to NASA-LUCY ground based occultation team, which confirmed 15094 Polymele's surface features and presence of smaller orbiting satellite.

**Massachusetts Institute of Technology**

Nov 2020 - Jul 2022

Technician - LLAMAS

Gábor Fűrész (PI) &amp; Mark Egan (Engineering supervisor)

- Assembled and modified opto-mechanical mounts and ground support equipment for *Large Lenslet Array Magellan Spectrograph* (LLAMAS) instrument according to assembly drawings. Inspected custom-fabricated parts using a coordinate measurement machine and prepared reports detailing measurements.
- Tested the efficiency of diffraction gratings at nominal orientation. Modified existing test equipment to measure blaze-angle transmission. Authored report detailing procedure, methods, results, and analysis.
- Prepared adhesives for bonding handling tabs to optical components. Bonded camera lenses into bezels. Developed and modified bonding procedure to best accommodate changing circumstances.
- Designed protective covers, fixtures, and tools using SolidWorks. Collaborated using different version control software - Git and SolidWorks PDM. Wrote software for precise control of DC servo motors, used to ensure highest standards of spectrograph fiber bonding and integration.
- Loaded and unloaded optical fibers into anti-reflective coating fixtures. Integrated the AR-coated fibers to the spectrograph by bonding with optical adhesive, with 100% accuracy. Authored and modified the fiber bonding and protective tube-pulling procedure to meet evolving science and safety needs.

**Massachusetts Institute of Technology**

May 2021 - Nov 2021

Research Assistant - STARSPOOT

Gábor Fűrész (MIT) &amp; Jennifer Burt (NASA-JPL)

- Developed a data pipeline for concatenating single-day observations from a multi-channel optical solar spectrometer. Modified pipeline routine to maintain compatibility with different data structures. Utilized data pipeline to collect spectrophotometry from different solar events.
- Created data analysis tools and objects for studying solar events obtained by spectrometer. Compared ground-based data to International Space Station observations from same epochs. Studied correlations between historical S-index, magnetic activity, total solar irradiance, and spectral solar irradiance.
- Determined limit of detection of solar events for the ground-based optical spectrometer. Pipeline and data tools served as supporting evidence in several forthcoming publications that describe the proposed space-based project scope.

**University College London & Wheaton College**

May 2019 - Jul 2020

Honors Thesis Student

Prof. Amélie Saintonge (UCL) &amp; Prof. Dipankar Maitra (WC)

- Coordinated joint thesis project between UCL and Wheaton College. Authored honors thesis detailing scientific rationale, results, and central conclusions of study. Presented to Wheaton and UCL faculty and students for critique and discussion. Received highest marks from faculty of both schools.
- Designed and implemented python data pipeline for use with derived data from xCOLD GASS, JINGLE, and SDSS galaxy surveys. Developed a linear Markov-chain Monte Carlo sampler to constrain relationship of cold-gas and dust components of star-forming galaxies from Balmer emission. Generalized the sampler to higher dimensions to include the inclination-dependent reddening in the calibration.

**University College London**  
Group Lead

Jan 2019 - Mar 2019  
Prof. Thanh Nguyen

- Led research group of 8 UCL students to determine the detection limits of lateral flow assays using photo-thermal heating of magnetic nanoparticles. Resolved conflicts between group members and determined group structure. Coordinated laboratory logistics and safety measures between student group and the Royal Institute of London.
- Prepared ferromagnetic nanoparticle solution and samples for observation. Designed setup of infrared laser and sample apparatus. Obtained and analyzed temperature data from a thermal camera for determination of optimal membrane type and solution concentration.
- Collaborated and authored report detailing group processes, results, & analysis. Received highest marks from UCL faculty and Royal Institute staff.

**Rutgers University New Brunswick**  
REU Research Assistant

May 2018 - Aug 2018  
Prof. Carlton Pryor

- Improved proficiencies in Pandas, NumPy, SciPy, and other data analysis tools to support investigations of dwarf satellite galaxy orbits.
- Designed, implemented, and modified data pipeline for use with ESA Gaia space telescope DR-2 data selections of dwarf satellite galaxies. Discovered small scale tidal tail around central core of dwarf satellite galaxy Carina using radial density measurements.
- Prepared and presented progress reports to Prof. Pryor on a weekly basis. Prepared and delivered final presentation at summer research symposium and to professors and graduate students of the physics and astronomy department.

**Wheaton College**  
Student astronomy projects

Aug 2017 - Dec 2018  
Prof. Dipankar Maitra

- Designed and 3D printed a mount for projection of sunlight on a 4.5" reflector telescope. Obtained and analyzed solar spectrum using a spectroscope. Observed spectral limb-reddening resulting from gas densities similar to the chromosphere. Authored report detailing methods, results, and analysis.
- Retrieved archived photometry from V404 Cygni outburst event obtained at Wheaton College in June 2015. Analyzed data using Aperture Photometry Tool. Identified two outburst events on the night of June 27, separated by roughly one hour. Authored report detailing methods, results, and analysis.
- Determined specifications of diffraction grating for use with DSLR camera. Obtained spectrum of Vega and Capella using grating and 30s exposure. Identified iron absorption features in both stars. Authored report detailing methods, results, and analysis.
- Retrieved x-ray binary data taken by MAXI x-ray telescope. Implemented Lomb-Scargle periodogram techniques to derive orbital periods of four different x-ray binary systems. Derived slight differences in period of binary 2S 1417-624. Authored report detailing methods, results, and analysis.

**Project P.A.N.O.P.T.E.S.**  
Student Collaborator

Sep 2017 - Dec 2018  
James Synge (Google Cambridge)

- Communicated between professors at Wheaton and outside collaborators to install, operate, and maintain autonomous exoplanet telescope inside Wheaton College observatory dome.
- Aligned P.A.N.O.P.T.E.S. exoplanet telescope for observation according to polar-alignment procedure using hand tools.
- Performed maintenance on the astronomy dome to ensure continuous observations using P.A.N.O.P.T.E.S.
- Modified existing dome control code for weather-automated and manual remote operation of telescope.

**NASA Langley Research Center**  
Summer Intern

May 2017 - Aug 2017  
Dr. Brian Walsh

- Designed, built, and operated a 2.1 & 1.06  $\mu\text{m}$  pump source for proof of concept atmospheric-monitoring mid-infrared Lanthanide-LuAG laser.
- Programmed a model to determine resonator stability based on resonator dimensions and elements. Determined resonator quality through spectroscopic tests.
- Performed spectroscopy on resonator components using mid-infrared and optical spectrometers. Optimized resonator setup from outcomes of spectroscopic tests and model predictions.

**Wheaton College**  
Undergraduate Research Assistant

Dec 2016 - May 2017  
Prof. John Collins

- Built Nd:YAG laser resonators from individual components. Modified existing laser configurations as necessary, including soldering new trigger circuits for a q-switch.
- Determined threshold energies for spontaneous emission using different resonator specifications.
- Exercised safe and appropriate use of voltmeters, oscilloscopes, and other electric and optical equipment.

## TEACHING

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**University of Michigan Physics Department**  
Lead Graduate Student Instructor

May 2023 - Jun 2024  
Ann Arbor, MI

- Organized course administration, including worksheet development, lab procedures, and grading practices, for introductory physics lab that serves 1000+ students and managed  $\sim 15$  graduate instructors each term.
- Communicated to all parties by acting as a liaison between undergraduate students, graduate instructors, introductory lab support staff, and faculty. Resolved grading disputes through collecting all pertinent information, meeting with undergraduate students, and meeting with department chairs and parents of students, on occasion.
- Led three teaching workshops for first-year students over four days throughout the academic year. Reformed training workshops for new graduate student instructors to better prepare them for teaching. Created additional workshops with other lead instructors and new graduate instructors to familiarize new instructors with how to manage classroom social dynamics.

**University of Michigan Physics Department**  
Graduate Student Instructor

Aug 2022 - Dec 2022  
Ann Arbor, MI

- Led laboratory sections of undergraduate students in life sciences disciplines through weekly labs focused on introductory physics concepts.
- Student feedback average of 4.72/5 in teacher evaluations related to instruction. Answered questions pertaining to lab content, fundamental concepts, and course policies throughout lab session.
- Held office hours once a week to assist students in all introductory physics classes with homework problems, exam preparation, and comprehension of fundamental concepts of physics. Organized meetings with struggling students outside of usual hours and tailored class sessions to better meet students needs

**Wheaton College Physics Department**  
Teaching Assistant

Aug 2018 - Dec 2019  
Norton, MA

- Increased engagement of Introductory Physics I & II students with in-class problems & labs through effective communication and classroom instruction.
- Performed laboratory setup and breakdown for class of 40+ students in accordance with schedule.
- Communicated student comprehension of specific topics to professors to increase participation.

**Wheaton College Physics Department**  
Physics Tutor

Aug 2018 - Dec 2018  
Norton, MA

- Assisted students with understanding concepts of physics to support problem sets and exam preparation.
- Increased engagement with struggling students by meeting outside of regular tutoring hours, communicated deficiencies to professors to optimize the classwork plan.
- Participated in tutor development meetings to enhance instruction and communication skills.

## OUTREACH

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**University of Michigan-Southern Illinois University**  
Eclipse Group Leader

Aug 2023 - May 2024  
Albuquerque NM, Burlington VT

- Led high school group of students to operate a solar telescope and take images of the sun during the 2023 annular eclipse and 2024 total eclipse.
- Teach high students from about physics of the sun, solar observations, and eclipses through virtual and in person presentations.
- Successfully operated and captured images of the 2023 annular eclipse on site in Albuquerque NM, and 2024 total eclipse on site in Burlington VT.
- Encouraged safe and responsible observations and discussed the science of eclipses with the public through several local news outlets, including NBC-5, Vermont Public Radio, and the Essex Reporter

**Wheaton College Astronomy Department**  
Observatory Guide

Aug 2016 - May 2020  
Norton, MA

- Showcased features of different telescopes to local tour groups at Wheaton College Observatory.
- Operate and adjust telescopes to show appropriate stars, objects, and events based on sky conditions.
- Educated children and adults in how to locate objects and explained features about the objects on sky.

## PUBLIC SERVICE

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**Best Buddies**  
Bud

Aug 2016 - Apr 2017  
Norton, MA

- Worked as a role model for a Norton MA resident with disabilities, including calling resident once a week, texting with resident about daily activities, and monthly meetings in group settings with resident.
- Assisted group leaders with monthly programming, including reserving event space, organizing smaller workshop groups with other buds, and managing catering orders.

## DEPARTMENT SERVICE

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- Designed art installation in University of Michigan Physics help room showcasing previous experiences by graduates of the undergraduate program, highlighting struggles overcame and success in their later lives.
- Member of UM physics graduate council from 2022 - 2024.
- Lead organizer and host of physics graduate student symposium in 2023, a weekly speaker series highlighting research projects from several departments in the University of Michigan.
- Member of UM physics DEI committee from 2022 - 2024.
- Member of APS chapter at UM from 2022 - 2024.
- Member and peer advisor of the Wheaton College physics club from 2016-2020.

## PRESENTATIONS

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### Invited talks

11/2021 LLAMAS Assembly Integration and Testing, Wheaton College, Norton MA

### Public talks

05/2020 Undergraduate honors thesis research, Wheaton College, Virtual

05/2020 Undergraduate honors thesis research, University College London, Virtual

09/2018 REU research on dwarf satellite galaxies, Wheaton College, Norton MA

08/2018 REU research on dwarf satellite galaxies, Rutgers University, New Brunswick NJ

### Poster Presentations

03/2024 LSSTCam Defects, Image Sensors for Precision Astronomy 2024 at SLAC, Menlo Park CA

06/2019 REU research on dwarf satellite galaxies, 234th AAS Meeting, St. Louis MO

03/2019 Magnetic nanoparticle research, UCL Physics department poster symposium, London UK

08/2018 REU research on dwarf satellite galaxies, Rutgers University, New Brunswick NJ

04/2018 Project P.A.N.O.P.T.E.S., Northeast Astronomy Forum, Suffern NY

## PUBLICATIONS

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### Papers

1. MacBride, Sean Patrick. (2020, May 10). Characterizing the Dust and Cold-Gas Content of Nearby Star-Forming Galaxies. Wheaton College Digital Repository, 2020.