

# SEAN MACBRIDE

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## EDUCATION

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### Wheaton College, Norton Massachusetts

B.A. in Physics, Honors

Minor in Astronomy

Aug 2016 - May 2020

GPA: 3.65 (cum laude)

Physics GPA: 3.76

- ★ Member and peer advisor of the Wheaton College physics club from 2016-present
- ★ Studied spring 2019 at University College London
- ★ Elected captain of the Wheaton College men's rugby team during 2019-2020 season. Elected match secretary from 2017-2019. Elected club safety officer from 2017-2019.

**Awards** Wheaton Centennial Grant for tremendous academic promise  
Boggess Family Foundation scholarship for achievements in physics

## RESEARCH EXPERIENCE

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### Massachusetts Institute of Technology

Technician - LLAMAS

November 2020 - Present

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

- Assembled and modified opto-mechanical mounts and ground support equipment for LLAMAS instrument according to assembly drawings. Inspected custom-fabricated parts using a coordinate measurement machine and prepared reports detailing measurements.
- Tested the efficiency of diffractive gratings at nominal orientation. Modified existing test equipment to measure blaze-angle transmission. Authored report detailing procedure, methods, results, and analysis.
- Prepared industrial adhesives for bonding handling tabs to optical components. Developed and modified bonding procedure to best accommodate changing circumstances. Successfully handled high pressure environments, resolving problems and eliminating risk of potential damage to optical components.
- 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. Authored and modified the fiber bonding and protective tube-pulling procedure to meet evolving science and safety needs.

### University College London & Wheaton College

Honors Thesis Student

Professor Amélie Saintonge (UCL) & Professor Dipankar Maitra (WC)

May 2019 - July 2020

- 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 MCMC sampler to higher dimensions to include the effects of inclination-dependent reddening in the calibration.

**University College London***Group Lead*

Jan 2019 - Mar 2019

*Professor 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

*Professor 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 Gaia 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.

**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. unit for observation according to polar-alignment procedure using hand tools.
- Performed maintenance on the astronomy dome to ensure continuous observation of P.A.N.O.P.T.E.S.
- Modified existing dome control code for weather-automated and manual remote operation of telescope.

**Wheaton College***Student astronomy projects*

Aug 2017-Dec 2018

*Professor Dipankar Maitra*

- 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 instrument. 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.

**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 Assistant*

Dec 2016 - May 2017

*Professor 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.

**OUTREACH**

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**Wheaton College Physics Department***Teaching Assistant*

August 2018 - December 2019

*Norton, MA, USA*

- 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*

August 2018 - December 2018

*Norton, MA, USA*

- 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.

**Wheaton College Astronomy Department***Observatory Guide*

August 2016 - May 2020

*Norton, MA, USA*

- 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.

**PRESENTATIONS**

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**Poster Presentations**

- Rutgers satellite galaxy research at Rutgers summer research symposium - August 2018
- Rutgers satellite galaxy research at 234th meeting of the American Astronomical Society - June 2019
- Project P.A.N.O.P.T.E.S. instrumentation at Northeast Astronomy Forum - April 2018

**Oral Presentations**

- Honors thesis defense to department of Wheaton College and University College London - May 2020
- Rutgers satellite galaxy research to Wheaton College physics department - September 2018
- Rutgers satellite galaxy research to Rutgers University physics and astronomy department - August 2018