Michael Astwood

mastwood.github.io mrastwoo@uwaterloo.ca

Education

University of Waterloo - 2021
BSc Honours. Mathematical Physics
Pure Mathematics Minor
Astrophysics Specialization

Westwood Collegiate - 2017
International Baccalaureate Diploma
Graduated with Honours
CAP Physics Exam Scholarship
UWaterloo Merit Scholarship

Programming

Scientific Computing

- **MATLAB**
  CasADI, Optimization Toolkit, Parallelization Toolkit
- **Python**
  NumPy, GEKKO, FEniCS

General Programming

- **C#**
  NET, XNA, Monogame
- **JavaScript**
  NodeJS, Express, Cheerio, Request, DiscordJS
- **Java**
- **Arduino**
- **HTML, CSS, XML, Markdown**

Outreach

- **UWaterloo Science Ambassador**
  Representing mathematical physics as one of three ambassadors to incoming applicants and first year students at open houses and outreach events
- **Director, Physics Interconnected**
  Coordinated marketing and developed the structure of the mentoring service in Fall 2018
- **Creative Director, Science Society**
  Designed marketing materials for science society events at UWaterloo during Summer 2018

Professional Experience

Perimeter Institute for Theoretical Physics
Research Assistant - September 2019 to Present
Supervised by Dr. William Donnelly

- Investigating BRST-like symmetries in 2-dimensional Yang-Mills gauge theories
- Readings in topological quantum field theory and string theory

Ingalls Quantitative Cell Biology Group
Research Assistant (NSERC USRA) - May 2019 to September 2019
Supervised by Dr. Brian Ingalls and Nate Braniff

- Numerically simulated stochastic dynamical systems using the Gillespie stochastic simulation algorithm to characterize optimal experimental designs
- Investigated various optimization algorithms for use in characterizing statistical models of genetic toggle switches
- Presented work at the end of the term to the Department of Applied Math

iGEM UWaterloo Mathematics and Modeling
Team Lead - October 2018 to Present
Team Member - February 2018 to October 2018

- Developed reaction-diffusion model for chemical uptake and degradation in plant roots for use in environmental analysis and prediction of our system behaviour
- Solved nonlinear reaction-diffusion model with the Finite Element Method
- Implemented a model predictive control scheme in python for controlling genetic and chemical mechanisms on a cellular level

Physics Undergraduate Society
President - January 2019 to May 2019
Other Positions - September 2017 to Present

- Ran series of seminars and lectures on topics in math and physics, including a weekly lecture series in undergraduate quantum field theory
- Managed a variety of projects over 5 terms, increasing outreach into the growing physics community significantly

Posters and Presentations

Engineering Herbicide Tolerance in Rhizobia
Conference Poster, Talk (iGEM 2019 Competition)

Characterization of Optimal Experimental Designs and Parameter Estimation Methods for a Genetic Toggle-Switch
Conference Poster (Canadian Undergrad Math Conference 2019)
Talk (UW Department of Applied Mathematics)

Dynamic Optogenetic Control of Co-Cultures
Conference Poster, Talk (iGEM 2018 Competition)

Projects

Geonomaly - CSA SpaceApps Challenge (National Finalist)

- Developed algorithm for detecting anomalous signals in geomagnetic data taken by GO-Canada magnetometers using modern techniques from signal processing such as the Hilbert-Huang transform and Short-Time Fourier Transform.

PHYS375 - Astrophysics III (Stars) Final Project

- Implemented Runge Kutta 45 (Fehlberg) algorithm in order to solve equations of stellar structure for modified main sequence stars