

Maxwell A. Fine

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EDUCATION

UNIVERSITY OF AMSTERDAM

2023 - 2025 (EXPECTED)

MSc, Physics & Astrophysics

THESIS: *Deciphering the local environments of repeating Fast Radio Bursts (FRBs) sources using scintillation*

SUPERVISORS: Prof. Ziggy Plenuis & Prof. Jason Hessels

UNIVERSITY OF TORONTO

2018 - 2023

B.Sc (Hons), Specialist in Physics & Astrophysics

THESIS: *Hunting for Fast Radio Bursts (FRBs) with SWIFT/bat*

SUPERVISORS: Dr. Ziggy Plenuis, Dr. Paul Scholz and Prof. Bryan Gaensler

THESIS: *Gravitational waves from magnetar giant flares*

SUPERVISORS: Dr. Sarah Gossan & Prof. Bryan Gaensler

RESEARCH INTERESTS

Fast Radio Bursts, Astrophysical transients, radio astronomy, multi-messenger astronomy, radio interferometry, observational cosmology, techniques, surveys, algorithms, data science in astronomy.

TECHNICAL SKILLS

I am highly skilled in **Python**, **Linux**, specializing in packages such as **Numpy**, **Scipy**, **Matplotlib**, **Pytorch**, **Pandas**, **Scikit-Learn**, **Presto**, **RM-TOOLS**, and **Astropy**. I am skilled in data analysis, Bayesian analysis, time-series analysis, algorithm development, Fourier analysis, signal processing, machine learning, deep learning, big data (Tb Scale), **Git**, **Bash**, **Docker**, cloud computing, and scientific computing. Additionally, I have moderate experience in **C++**, **SQL**, **AWS**, and **Kubernetes**.

PUBLICATIONS

Maxwell A. Fine, Cameron L. Van Eck, & Luke Pratley “Correcting Bandwidth Depolarization by Extreme Faraday Rotation”, Monthly Notices of the Royal Astronomical Society 2023. [ArXiv link](#).

AWARDS

3rd Year John Pounder Prize In Astronomy

FALL, 2021

Awarded to a full-time student entering the third year of a physical sciences program on the basis of excellent achievement in astronomy courses (\$300)

Undergraduate Student Research Award (USRA)

SUMMER, 2021

Canadian Institute for Theoretical Astrophysics (\$6,000)

Student Excellence and Leadership Award

2019-2020

Department of Physical & Environmental Sciences

For academic excellence and community leadership (\$350)

2nd Year John Pounder Prize In Astronomy

FALL, 2019

Awarded to a full-time student entering the second year of a physical sciences program on the basis of excellent achievement in astronomy courses (\$300)

RESEARCH EXPERIENCE

Hunting for Fast Radio Bursts (FRBs) with the 25m Dwingeloo Radio Telescope (DRT)

Summer 2024

Astron & JIVE Summer Research Program

Advisors: Dr. Tammo Jan Dijkema, and co-advisor Professor Jason Hessels.

I Used the 25m DRT to search for bright repeating Fast Radio Bursts (FRBs) with goal being to show that the DRT can observe FRBs, and to understand the potential connections between repeating and apparently non-repeating FRBs. I Learned radio astronomy techniques, and methodology. Built the data processing pipeline to find extragalactic transient FRB signals based on **Presto** & **Fetch**. Tested the pipeline by injecting simulated FRBs, and looked at bright the Crab pulsar for hundreds of hours. Attempted to observe repeating FRB FRB20240209A, made no confirmed detections.

Hunting for Fast Radio Bursts (FRBs) with SWIFT/bat

2022-2023

Dunlap Institute: Summer Undergraduate Research Program (SURP)

AST425: Undergraduate Thesis

Supervisor: Dr. Ziggy Plenuis, Dr. Paul Scholz and Prof. Bryan Gaensler

This project was on searching for and placing limits on the X-ray & gamma-ray emission from CHIME/FRBs using Swift/BAT and GUANO. I learned about writing data pipelines, convolutions, and approaches to multi-messenger astronomy. I used the Swift/Bat API to download data from Swift/Bat, and the Swift/Bat analysis software written in **Bash**, and **Python** to search for emission at times and locations corresponding to FRB detections made by CHIME.

Gravitational waves from magnetar giant flares

PHYD01: Undergraduate Thesis

Winter, 2022

Supervisor: Dr. Sarah Gossan & Prof. Bryan Gaensler

I Determined if it is possible for the next generation of ground-based gravitational wave detectors to observe gravitational wave emission from magnetar giant flares (It is not).

Developing robust error analysis for radio polarization surveys

Dunlap Institute: Summer Undergraduate Research Program (SURP)

Summer 2021

Supervisor: Dr. Cameron L. Van Eck

I helped to develop part of the error analysis pipeline for Polarization Sky Survey of the Universe's Magnetism (POSSUM). It uses the **RM-Tools** package. I found that one of the error estimates was too small, and worked on fix.

Hunting for radio sources in extreme magnetized environments

Dunlap Institute: Summer Undergraduate Research Program (SURP)

Summer 2020

Supervisor: Dr. Cameron L. Van Eck

Developed an improvement to the Rotation Measure (RM) synthesis algorithm used in **RM-Tools** for cases with extreme bandwidth depolarization where the traditional technique was no longer valid. This led to an implementation for bandwidth depolarization in the **RM-Tools** package, and a publication.

TEACHING EXPERIENCE

UofT Teaching Assistant

PHYA10: Introduction to Physics I for the Physical Sciences

Fall, 2021

Ran weekly two hour long practical sessions for ~ 10-15 students, and marked assignments & exams

UofT Teaching Assistant

PHYA22: Introduction to Physics II for the Life Sciences

Winter, 2021

Ran weekly two hour long practical sessions for ~ 10-15 students, and marked assignments & exams

UofT Teaching Assistant

PHYA11: Introduction to Physics I for the Life Sciences

Fall, 2020

Ran weekly two hour long practical sessions for ~ 10-15 students, and marked assignments &

exams

UofT Facilitated Study Group Leader

PHYA10: Introduction to Physics I for the Physical Sciences Fall, 2020
Ran weekly study group sessions for ~ 10 -15 students. Attended lectures, created practice problem sets, and hosted review sessions for midterm and final exam.

UofT Facilitated Study Group Leader

PHYA21: Introduction to Physics II for the Physical Sciences Winter, 2020
Ran weekly study group sessions for ~ 10 -15 students. Attended lectures, created practice problem sets, and hosted review sessions for midterm and final exam.

UofT Facilitated Study Group Leader

PHYA10: Introduction to Physics I for the Physical Sciences Fall, 2019
Ran weekly study group sessions for ~ 10 -15 students. Attended lectures, created practice problem sets, and hosted review sessions for midterm and final exam.

COMMUNITY AND OUTREACH

25m Dwingeloo Radio Telescope (DRT) Outreach Volunteer Summer 2024

I led public tours and demonstrations of the 25m radio telescope. Group size of 3-20 people. Talked about the history of radio astronomy. Typically observed the 21cm H line, and observed a pulsar.

Volunteer Age of the Universe Summer 2023

I helped create one of the Jupyter-notebooks for a astronomy workshop for highschool students in Toronto. I helped make the notebook on the Cosmic Microwave Background (CMB). See the <https://github.com/simrannerval/Age-of-the-Universe> organized by Dr. Simran Nerval.

Dunlap Institute: Astrotours Volunteer 2022-2023

I answered questions from the public, and operated small optical telescopes.

Scarborough Campus Student Union: Director for Department of Physical & Environmental Sciences 2021-2022

Attended monthly Student Union meetings with the other director & executive officers. Aided in the planning of student lead initiatives including the fall of 2020 Climate Strike, served as liaison between student union and department association.

Winter Solstice Telescope Night Winter, 2021

Telescope operator

Environmental & Physical Sciences Student Association: Director for Physics & Astrophysics 2018-2020

In charge of planning and programming events, including the physics & astronomy 'mix and mingle', organization of the Physics Study Centre, and participation in outreach events.

Environmental & Physical Sciences Student Association: Physics Tutor 2019-2022

Volunteer tutor at the Physics Study Centre

Dunlap Institute: Earth Hour Volunteer Winter, 2019

I got to stand by a giant inflatable Moon, and talked about the formation of the Moon, and where Moon landings have occurred.