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Dear Members of the PhD Admissions Committee,

I am writing to my strong interest in the PhD project “Into the unknown - Discovering the stars and exoplanets emitting at low-frequencies,” supervised by Dr. Joseph Callingham. My background in astrophysics, particularly in radio astronomy and work at [Astron](#), aligns well with the goals of this research. I am interested in astrophysical transients, fast radio bursts, pulsars, radio astronomy, multi-messenger astronomy, radio interferometry, observational cosmology, cosmic magnetism, techniques, surveys, algorithms, and data science in astronomy.

My master’s thesis is on using scintillation to study the local environments of FRBs; more specifically their emission size regions, which allows for the differentiation between the two broad categories of emission models. Further, I will be investigating the time-variability of scintillation of repeating FRBs detected by [CHIME](#) which will give further insights into their local environments. My supervisors are Professor Ziggy Pleunis, Professor Jason Hessels.

This past summer I worked at Astron, in the Netherlands as a summer research fellow utilizing the historic [25m Dwingeloo Radio Telescope \(DRT\)](#). The project was supervised by Professor Jason Hessels and Dr. Tammo Jan Dijkema. The DRT was the largest radio telescope in the world when it was built in 1956, today it is a museum and national monument in the Netherlands. It is operated by volunteers who also give public tours. Recently there has been interest in using ‘small’ 25m-35m radio telescopes for high cadence FRB observations. I became one of the volunteers, and developed a real-time detection pipeline for repeating FRBs. The highlight of this project was [detecting a burst from FRB20240619D](#), showcasing the DRT’s enduring scientific capability. The results will contribute to an upcoming paper and the DRT will be used in future FRB observation campaigns.

While studying at the University of Toronto, I worked on four research projects. Instead of doing one thesis, on special request I did two. I was selected three years in a row for a competitive UofT summer research fellowship. My second undergraduate thesis involved a γ -ray counterpart search for CHIME/FRBs using Swift/BAT data, where I learned about multi-wavelength data analysis.

Two of my summer research fellowships focused on rotation measure (RM) synthesis, a key technique to study cosmic magnetism. These projects were supervised by Dr. Cameron Van Eck and Professor Bryan Gaensler. For the first project, I contributed to making a RM synthesis algorithm for cases of extreme bandwidth depolarization, results that have been integrated into the [RM-Tools](#) package. This project was motivated by a recent discovery of extreme bandwidth depolarized sources, for which the traditional RM synthesis algorithm was no longer adequate. This work culminated in my [first-author publication](#) in the Monthly Notices of the Royal Astronomical Society. The second project focused on error testing the error analysis pipeline for [POSSUM](#). I found that one of the estimated errors was too small, and implemented a correction. The second project was partially funded by a grant from the Canadian Institute for Theoretical Astrophysics (CITA).

I am excited about the prospect of working with LOFAR, I heard about it years ago and I visited it over summer. It is my favorite telescope. Working on cutting-edge interferometric techniques sounds most luminous.

Thank you for considering my application. I am looking forward to the opportunity to discuss this exciting research project.

Astronomy is looking up!

Maxwell A. Fine

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