

# Mac Robertson Scholarship Report

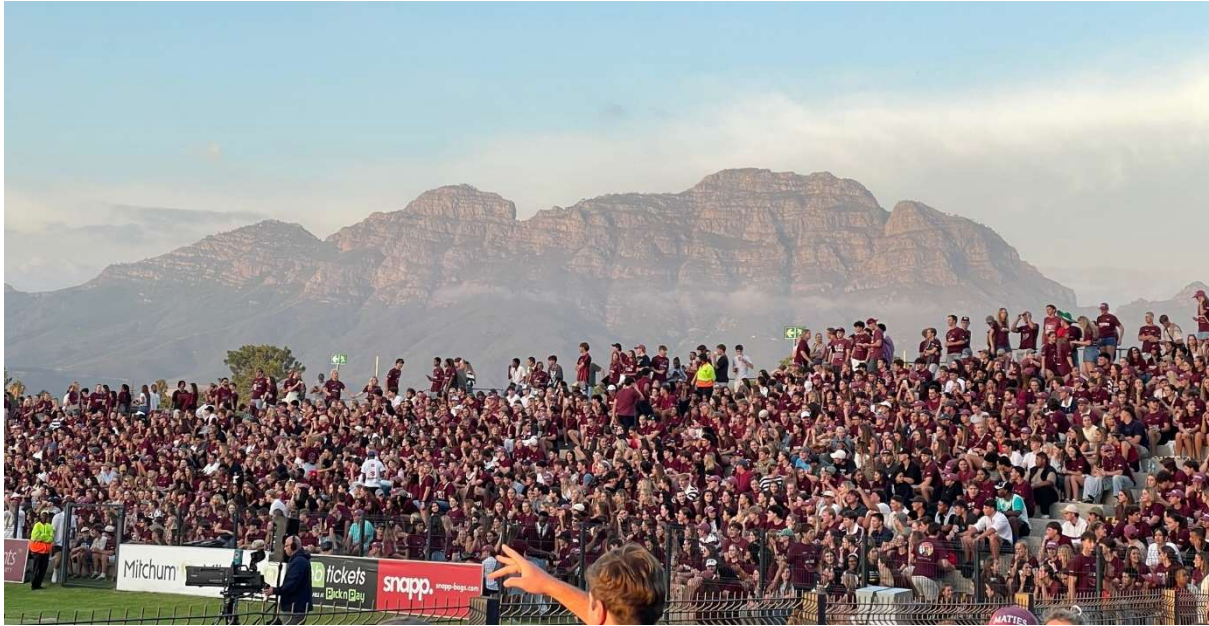
Fraser Eadie

Stellenbosch University, Cape Town, South Africa

## About me

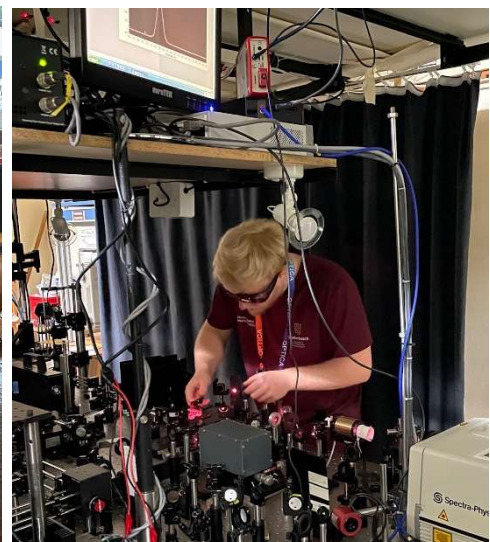
My name is Fraser Eadie, and I come from a town in Perthshire in Scotland. I am a 2nd-year PhD student within the lab of Dr Akhil Kallepalli. My research mainly focuses on Fourier ptychography/phase manipulation to improve polarised imaging of malaria-infected red blood cells. Specifically, Fourier ptychography uses different angles of an LED array to acquire additional phase information, thereby drastically improving the resolution of the sample images, enhancing detection capabilities. I was awarded £5,000 by the MacRobertson Scholarship in 2025 for a 2-month research placement at the University of Stellenbosch in South Africa. Stellenbosch is a campus town, roughly a 45-minute drive from Cape Town, and home to a university rich in culture and history.





### Why did you apply for the Travel Scholarship?

I applied for the Travel Scholarship because I had been offered the opportunity to collaborate with Dr Pieter Neethling's lab, subject to funding. Dr Pieter Neethling is an expert in ptychography, phase manipulation, and ultrashort pulses, and has recently published work on Polarised Fourier ptychography, all of which is invaluable knowledge for my PhD and academic career, which I could not have gained otherwise.



Another critical benefit for me and my future career in academia was the experience of working in a different lab/country and with new equipment, such as a femtosecond pulsed laser (the first in Africa!) and a spatial light modulator. I have always wanted to visit South Africa because of its amazing culture, wildlife, landscapes, and history.

### Details of your visit.

My main PhD project has focused on utilising polarised Fourier ptychography microscopy to detect and extract the phase information of hemozoin in malaria-infected red blood cells. Currently, I have built the setup and have several promising results in detecting the hemozoin and measuring the optical phase properties of the crystals. The aim of this placement was to deepen my knowledge of ptychography, specifically polarised Fourier ptychography, by working with Eugene Fouche and Professor Neethling, both published authors in the field. During my visit, my second supervisor, Dr Bosman, an expert in ultrafast lasers and microscopy, gave me many ideas for future microscopy and ptychography work. Additionally, it was to gain invaluable lab experience working in a high-powered ultrashort-pulsed laser lab for the first time, learning about complex optical components such as an SLM and chirped mirrors, which was a fantastic experience for me throughout my PhD and future career. Finally, I attended the weekly group and SPIE meetings, which allowed me to network with many other researchers in photonics, attend several talks, and give a talk on my research to the society.



### Impact of the Travel Scholarship

In the optics lab, we focused on manipulating the phase of ultrashort laser pulses to increase the system's optical resolution, with long-term applications in Optical Coherence Tomography. The general idea was to expand the pulse's temporal bandwidth via designed transfer functions to improve the signal-to-noise ratio and increase the system's resolution (as far as I am aware, it would be the first time this has been done optically). Currently,



we are finishing the paper and plan to submit it promptly, with potential for another paper building upon the work in the future, continuing the collaboration.



## Acknowledgements

I'd like to thank the University of Glasgow for granting me the MacRobertson Travel Scholarship and the EPSRC Research Excellence Award for funding this research visit. Additionally, I would like to thank Eugene, Pieter, Gurthwin and everyone at Stellenbosch for being incredibly good hosts and integrating me into their fantastic research and lifestyle. Finally, I would like to thank my supervisors, Akhil and Giuseppe, for their continued wisdom and support throughout my PhD.



