Thato Thapo

Curriculum Vitae

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If at the end of a day you understand at least one concept or tool that you didn't understand yesterday, then it was a productive day.

Education

Present	**Postgraduate Certificate in Education**, *University of Cape Town*.
2023-2025	**M.Sc. in Applied Mathematics**, *University of Cape Town*.
2022	**Bachelor of Science (Honours) in Applied Mathematics**, *University of Cape Town*.
2022	**Foundation Programme in Design Thinking**, *Hasso Plattner School of Design Thinking in Afrika**, Cape Town.
2018–2021	**Bachelor of Science in Physics and Applied Mathematics**, *University of Cape Town*.
2015–2017	**National Senior Certificate**, *St. Matthews Secondary School*, Soweto.

Masters Thesis

Title	**Carroll Physics in General Relativity: Understanding the Carroll Limit of the Singularity Theorem**
Supervisors	Dr. Shaijd Haque & A/Prof. Bret Underwood
Description	This thesis explored the implications of the Carroll limit in general relativity, cosmology, relativistic field theory, and early universe physics. The symmetries of the Carroll group were studied, which informed the subsequent studies of Carrollian fields and fluids. The covariant formulation of Maxwell's theory of electromagnetism was explored in this limit which led into understanding the singularity theorem and the consequences of the Carrollian regime. The results of this project opened the door to alternative studies that can be performed to further understand inflation and singularities in cosmology.

Projects

Honours Project	**Relativistic Neutron Stars Beyond General Relativity:** Solving the TOV equations in General Relativity and Metric $f(R)$ Gravity which is an extended theory of gravity, to describe static, spherically symmetric neutron stars. The TOV equations are solved using various numerical methods, and the results are used to find consistencies between the two theories of gravity. Can be downloaded here.
Design Thinking	**Mobile Activation Truck bringing Solution Space into the Philippi Community:** A solution devised to address a challenge faced by youth in Philippi, where Philippi Village (a building complex in the community) and Solution Space (inside Philippi Village) exist to provide resources and opportunities to the community; however, community members feel intimidated by the space and the opportunities are not very visible. Can be downloaded here.
Physics Final Year	**MC simulations for the EPR quantum entanglement experiment:** Developing and using Monte Carlo code to understand the possibility of conducting an Einstein-Podolsky-Rosen quantum entanglement experiment using Positron Emission Particle Tracking infrastructure at UCT.

Applied Math Final Year — **Axions in the extension of the Standard Model of Physics:** Discussed the History of the Axion Particle and its connections to the Standard Model, by exploring various topics in General Relativity and Quantum Chromodynamics.

Conferences, Schools and Workshops

January 2025 — **Seventh Mandelstam Theoretical Physics School and Workshop:** Computational Holography

April/May 2024 — **14th Joburg School on String Theory:** Recent trends in CFT and the Gauge/Gravity correspondence

January 2024 — **Sixth Mandelstam Theoretical Physics School and Workshop:** Recent developments in Large N, Holography and Complexity

October 2023 — **13th Joburg Theoretical Physics School:** Recent developments in String Theory

January 2023 — **Fifth Mandelstam Theoretical Physics School and Workshop:** Recent developments in Entanglement, Large N in QFT and String theory.

Awards & Achievements

Exness Scholarship — **Fintech Scholarship Programme**. Full Merit Scholarship towards Masters studies.

UCT Scholarship — **Masters Research Scholarship 2023-2024**. Merit Scholarship towards my Masters research.

UCT Plus 2022 — **Gold Award**. 60hrs+ in active learning leadership.

UCT Plus 2022 — **Gold Award**. 60hrs+ in an elected leadership role at UCT.

UCT Plus 2021 — **Gold Award**. 60hrs+ in an elected leadership role at UCT.

UCT Plus 2020 — **Gold Award**. 60hrs+ in an elected leadership role at UCT.

Gauteng DBE Awards 2018 — **Top Physical Sciences Student in Gauteng, 2017**.

Experience & Volunteering

2025 — **Teaching Practice**, Mathematics Department, Wynberg Girls' High School.
Taught Mathematics to Grade 8, 9, and 10 classes. Under the mentorship of the Mathematics Department of the school including the subject head.

2022-2025 — **Teaching Assistant**, Department of Mathematics and Applied Mathematics, UCT.
TA: MAM2000W, MAM2040F, MAM1043H, and MAM1010F [Linear Algebra, Differential Equations, Mathematical Modelling and Dynamics, and Financial Mathematics] (Responsibilities: Weekly tutorial sessions, grading tests, and exams)

2023-2025 — **Teaching Assistant**, Department of Physics, UCT.
Main TA for PHY1013F [Physics for Engineers] (Responsibilities: Tutoring course material, Setting up and running weekly help sessions, grading tests and exams).
Tutored: PHY1031F and PHY1013S [General Physics and Physics for Engineers] (Responsibilities: Tutoring and Lab Demonstrations, grading lab reports).

2023 — **Academic Training Internship Programme (ATIP)**, Department of Mathematics and Applied Mathematics, UCT.
Training given to people who wish to pursue lecturing in the sciences (mainly mathematics) in the future.

2018-Present — **Volunteer Tutor**, Golden Future Project, UCT.
Tutored High School Mathematics and Physics, and provided Computer Literacy sessions.

2023-Present — **Volunteer Tutor**, The Rising Star Project, SAAO (South African Astronomical Observatory), Thandokhulu High School.
Tutored Physics to Matriculants.

Positions of Responsibility

2024	Postgraduate Representative Council, UCT Math Department
2021/22	Chairperson of the Golden Future Project, UCT (Outreach tutoring society).
2021	Undergraduate Representative, UCT Department of Physics.
2021	President of the Society for Physics Students, UCT.
2020/21	Vice-Chairperson of the Golden Future Project, UCT.
2019–2021	Secretary of CLAWs, UCT (Tabletop gaming society).

Interests

Scientific	Cosmology and Gravity, Quantum Gravity, Dark Matter, Quantum Chromodynamics, Data Analysis, Data Science, Numerical Methods and Scientific Programming, and Monte Carlo simulations.
Hobbies	Chess, Tabletop Gaming, Live-Action Role Playing, Web Development, Creative Writing.

Skills

Software	Python, MS Office, LaTeX, Mathematica, MySQL, PowerBI, Tableau, Maple, Matlab, Julia, Miro, LabView, USX.
Fluent Languages	English, Southern Sotho (home language), isiZulu, Setswana, IsiXhosa.