Paper Submission Form - SAIP2025 Proceedings

Sections A, C, D, and E must be completed by all authors (including students) who submit papers. Section B is compulsory for students who submit manuscript(s).

Section A: Paper Submission Information

Paper/Abstract ID	065
Paper title	Laplacian eigenmodes in twisted periodic topologies for new physics models
Corresponding Author Name & Surname:	Anele M. Ncube
Corresponding Author Email Address:	ancube@uj.ac.za

Section B: For Students & Supervisors

Supervisor Name & Surname:	Professor Alan S.Cornell
Supervisor Email Address:	acornell@uj.ac.za

For this paper, the supervisor must agree/disagree with the following statements.

	Yes	No
1. I am aware that the above-mentioned paper is being submitted for possible publication in the Proceedings of the SAIP Conference. I am satisfied that the presented work is that of the listed authors. I hereby give consent to the submission	✓	
2. I have proof-read the manuscript	✓	
3. I am satisfied that the manuscript is written in appropriate English and is sufficiently free of grammatical and spelling errors	✓	
4. I am familiar with the required manuscript format ("House Style"), and I am satisfied that this manuscript meets the criteria. I am aware that manuscripts not conforming with House Style may be desk rejected	✓	
5. I am satisfied that the scientific content of this manuscript is of sufficient standard for it to be considered for publication in the Proceedings of the South African Institute of Physics Conference Proceedings	✓	

Student Name & Surname: Anele M. Ncube   Signature: …………………   Date: 30/07/2025

Supervisor Name & Surname: **Alan S Cornell**   Signature: …………………   Date: **31 July 2025**

Section C: Suggested Reviewers

Obtaining the two referee reports necessary for DHET subsidy is an onerous task.

Please provide the names and contact details of three qualified South African and/or international referees. Referees should have a PhD and expertise in the relevant area of Physics. Do not recommend referees who have co-authored a work with any of the authors on the manuscript within the past five (5) years. Manuscripts without three recommended referees may be subject to desk rejection.

Suggested Reviewers in your Research Field (Both local & international)	Reviewer Names & Surname	Reviewer's Email Address(es)
Suggested reviewer #1	Prof. Ebrahim Momoniat	emomoniat@uj.ac.za
Suggested reviewer #2	Prof. William Horowitz	wa.horowitz@uct.ac.za
Suggested reviewer #3	Prof. Hua-Sheng Shao	hshao@lpthe.jussieu.fr

Section D: Declaration of Novelty and Use of AI

How is this submitted manuscript scientifically novel?

The manuscript describes how to pragmatically apply physics-informed neural networks (PINNs) to solving Laplacians on non-trivial topologies that include the nilmanifold. The nilmanifold is one calculable example from the negatively-curved extra-dimensional space category (spaces that have been seldom explored in the literature due to the analytically intractable equations associated with them). Yet, some of the interesting particle physics models use these spaces as internal manifolds. This work is a step toward accessing the negatively curved extra-dimensional spaces using a method that is flexible (i.e. allowing for adaptability to the specifics of a problem) with accuracies comparable and possibly improving on previously used numerical techniques (in the context of nilmanifolds, a numerical implementation of Fourier analysis has been used previously, but it is limited by truncation errors and instability).

Please see the Author Guidelines for the AI use policy.

How was AI used in the generation of this manuscript?

Grammarly extension on Chrome was used to proof-read text in Overleaf.

Section E: Plagiarism

	Yes
I am aware that plagiarism detection software may be used on my manuscript.	yes