Jonathan Shock - CV

Personal Information

Name and title:	Associate Professor Jonathan Phillip Shock.
Date of Birth:	16 September 1979.
Place of Birth:	Oxford, UK.
Citizenship:	British.
Work Address:	Department of Mathematics and Applied Mathematics, University of Cape Town, 7701 Rondebosch, South Africa.
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Education, research and advisory positions

2026-	**Board of Directors, Lanfrica Labs.**
2026-	**Executive Committee member of the South African AI Association (SAAI).**
2025-	**Advisory board member for Awarenearth.**
2025-	**Advisory board member for Conscium.**
2025-Present	**Chair, International Alliance of Research Universities (IARU) Working Group on AI.**
2024-Present	**Interim Director of the AI Initiative at the University of Cape Town.**
2022-Present:	**Associate Professor at the University of Cape Town, department of Mathematics and Applied Mathematics.**
2021-Present:	**Adjunct Professor at the INRS, Montreal, Canada.**
2017-present:	**Senior Lecturer at the University of Cape Town, department of Mathematics and Applied Mathematics.**
Jul 2013-2017:	**Lecturer at the University of Cape Town, department of Mathematics and Applied Mathematics.**
From Sept 2011: Voluntary	**Scientific Consultant to the 166 Highschool, Beijing, China.**
Jan 2011-Jan 2013	**Postdoctoral position at the Max Planck Institute for Physics in Munich as a Marie Curie fellow.**
2007-:2010	**Postdoctoral position at the department of theoretical physics at the university of Santiago de Compostela in Spain.**
2005-2007:	**Postdoctoral position at the Institute of Theoretical Physics in Beijing.**
2002 - 2005:	**Ph.D. student in the High Energy Theory group at the University of Southampton.**
1998-2002:	1^{st} **Class Honours, MPhys, Bristol University.**
1990-1997:	**Secondary school education at Abingdon School, England.**

Publications

1. *When Better Prediction Does Not Improve Admission: Predictive Validity and Decision Utility in First-Year University Mathematics, M. Mokhithi, J.P. Shock, Education Sciences 16 (11), 1796, 2026*

2. *How Could Consciousness Be Cultivated in a Machine? (book chapter), M. Solms, J. Shock, Perspectives on Machine Consciousness, 124-144, Taylor & Francis, 2026*

3. *Interoceptive Attention as Dynamic Homeostatic Prioritization in a Foraging Agent, S.J. Grimbly, N. Kuske, E.A. Boonstra, B.A. Bassett, C. van Hoof, R. Hodson, B. Rosman, R. Smith, M. Solms, J.P. Shock, From Animals to Animats 18 (SAB 2026), Lecture Notes in Computer Science, 192-203, Springer, 2026*

4. *Big Brains and Changing Environments: Cause or Consequence?, S. Heesom-Green, J. Shock, G. Nitschke, Proceedings of the Genetic and Evolutionary Computation Conference (GECCO) Companion, 121-124, 2026*

5. *Intention Inference Under Execution Noise: Separating Aleatoric and Epistemic Uncertainty in Social Dilemmas, K. Mahadew, J.P. Shock, Symposium on Probabilistic Machine Learning (ProbML 2026), Proceedings of Machine Learning Research 327, 398-424, 2026*

6. *From theory to practice, and back: Student evidence testing ZPD, APOS, CLT, and constructivism in mathematical thinking workshops, M Mokhithi, A Campbell, J Shock, P Padayachee, Education Sciences 16 (3), 385, 2026*

7. *Inferring Affective Consciousness in an Artificial Agent: A Case Study, M. Solms, S.J. Grimbly, B. Bassett, E. Boonstra, R. Hodson, N. Kuske, K. Mahadew, B. Rosman, C. van Hoof, J. Shock, Journal of Consciousness Studies 33 (7-8), 14-34, 2026*

8. *Thermodynamics and DC conductivity of 2D anisotropic fluids from axion holography, A. Ballon-Bayona, J.P. Shock, D. Zoakos, JHEP 2025, 2 (2025)*

9. *Artificial intelligence for HIV care: a global systematic review of current studies and emerging trends, S. Ngcobo et al, Journal of the International AIDS Society 28 (10), 2025 (2026 JIAS Impact Award)*

10. *Diminishing Returns as a Lever for Fair Cooperation in Multi-Agent Reinforcement Learning, C Formanek, K Letsholo, J Shock, Southern African Conference for Artificial Intelligence Research (SACAIR), Vol. 6, Dec 2025.*
`https://2025.sacair.org.za/online-proceedings/Papers/paper_78.pdf`

11. *Energy Costs and Neural Complexity Evolution in Changing Environments, S Heesom-Green, J Shock, G Nitschke, Proceedings of the 2025 Conference on Artificial Life, 551-560*

12. *Is an Exponentially Growing Action Space Really that Bad? Validating a Core Assumption for using Multi-Agent RL, R de Kock, A Pretorius, J Shock, Proceedings of the 24th International Conference on Autonomous Agents and Multiagent Systems, 2025*

13. *Lessons learnt and insights shared: The Diagnostic Mathematics Information for Student Retention and Success (DMISRS) Case Studies Dialogue on teaching first-year mathematics in South Africa, S. Steyn et al, Perspectives in Education 43 (4), 364-410, 2025*

14. *Putting Data at the Centre of Offline Multi-Agent Reinforcement Learning, JC Formanek, L Beyers, CR Tilbury, JP Shock, A Pretorius, Journal of Data-centric Machine Learning Research (DMLR), Vol. 3, Paper 11, pp. 1–24, 2026*

15. *Optimisation of Resource Allocation in Heterogeneous Wireless Networks Using Deep Reinforcement Learning, O Giwa, J Shock, J Du Toit, T Awodumila, 2026 Joint European Conference on Networks and Communications & 6G Summit (EuCNC/6G Summit), 116-121, 2026*

16. *'I call it math therapy': student narratives of growth, belonging and confidence in mathematical thinking workshops, M Mokhithi, A Campbell, J Shock et al, International Journal of Mathematical Education in Science and Technology, 2025*

17. *Dispelling the Mirage of Progress in Offline MARL through Standardised Baselines and Evaluation, C. Formanek, C. Tilbury, L. Beyers, J.P. Shock, A. Pretorius, NeurIPS 2024, Article No. 4431, pp. 139650-139672*

18. *Increasing the location rate of positron emission particle tracking (PEPT) measurements for froth flotation, R Perin, SW Peterson, J Shock, P. Brito-Parada, D. Mesa, K Cole, Minerals Engineering 219, 109057, 2024*

19. *Opportunities of Reinforcement Learning in South Africa's Just Transition, C. Formanek, C. Tilbury, J.P. Shock, Southern African Conference on AI Research, 2024*

20. *On the Ability of Positron Emission Particle Tracking (PEPT) to Track Turbulent Flow Paths with Monte Carlo Simulations in GATE, R. Perin, K. Cole, M.R. van Heerden, A. Buffler, Y. Lin, J. Zhang, P.R. Brito-Parada, J.P Shock, and S.W. Peterson, Appl. Sci. 2023, 13(11), 6690*

21. *PEPT-EC, a location algorithm based on anomaly detection for positron emission particle tracking (PEPT), R Perin, SW Peterson, J Shock, K Cole, 2023 IEEE Nuclear Science Symposium*

22. *Policy-based Reinforcement Learning for Generalisation in Interactive Text-based Environments, EACL 2023, E. Toledo, J. Shock, J. Buys*

23. *Magnetising the N=4 SYM Plasma, JHEP 06 (2022) 154, A Ballon-Bayona, J. Shock, D. Zoakos*

24. *Positron Emission Particle Tracking (PEPT): Data analysis techniques for tracking multiphase flows, R. Sitoboli, R. Perin, K. Cole, J. Shock, S. Peterson, Proceedings of SAIP2022, the 66th Annual Conference of the South African Institute of Physics, ISBN 978-0-6397-4426-1, 2022*

25. *An analysis of the time-frequency structure of several bursts from FRB 121102 detected with MeerKAT, Mon.Not.Roy.Astron.Soc. 505 (2021) 2, E. Platts et al.*

26. *Correlation constraints for regression models: controlling bias in brain age prediction, Front. Psychiatry, 18 February 2021, M. Treder, J. Shock, D. Stein, S Du Plessis, S. Seedat, K. Tsvetanov*

27. *Remarks on Fermions in a Dipole Magnetic Field, JHEP 2021 (82), J. Murugan, J. Shock, R. Slayern*

28. *"We have already heard that the treatment doesn't do anything, so why should we take it?": A mixed method perspective on Chagas disease knowledge, attitudes, prevention, and treatment behaviour in the Bolivian Chaco - PLOS Neglected Tropical Diseases, 2020, S. Parisi et al*

29. *A game-theoretic analysis of networked system control for common-pool resource management using multi-agent reinforcement learning, NeurIPS 2020, A. Pretorius, S. Cameron, E. Van Biljon, T. Makkink, S. Mawjee, J. du Plessis, J. Shock, A. Laterre, K. Beguir*

30. *Magnetic catalysis and the chiral condensate in holographic QCD, JHEP 2020 (10) 193, A Ballon-Bayona, J. Shock, D. Zoakos*

31. *Structural neuroimaging biomarkers for obsessive-compulsive disorder in the ENIGMA-OCD consortium: medication matters, Transl Psychiatry 10, 342 (2020), W. Bruin et al.*

32. *The relationship between mindset and academic achievement at university: A quantitative study of South African students, 2020 IFEES World Engineering Education Forum - Global Engineering Deans Council (WEEF-GEDC), M. Mokhithi, A. Campbell, J. Shock.*

33. *Outcome prediction with serial neuron-specific enolase and machine learning in anoxic-ischaemic disorders of consciousness, Computers in Biology and Medicine 107 (2019) 145–152, E. Muller, J. Shock, A. Bender, J. Kleeberger, T. Hogen, M. Rosenfelder, B. Bah, A. Lopez-Rolon*

34. *Astrophysical Quantum Matter: Spinless charged particles on a magnetic dipole sphere, General Relativity and Gravitation 53, 29, 2021, J. Murugan, J. Shock, R. Slayen*

35. *A cross-sectional, descriptive study of Chagas disease among citizens of Bolivian origin living in Munich, Germany - BMJ Open 7(1), 2017, M. Navarro et al*

36. *A Universal Order parameter for Inverse Magnetic Catalysis, JHEP 2017 (10) 38, A. Ballo-Bayona, M. Ihl, J. Shock, D. Zoakos*

37. *Consciousness Indexing and Outcome Prediction with Resting-State EEG in Severe Disorders of Consciousness, Brain Topography 31(5), 848-862, 2018, S. Stefan, B. Schorr, A. Lopez-Rolon, IT. Kolassa, J. Shock, M. Rosenfelder, S Heck, A.Bender*

38. *Quantum discord in de Sitter space - Physical Review D 94(12), 2016, S. Kanno, J. Shock, J. Soda.*

39. *The Information Metric on the moduli space of instantons with global symmetries, Phys.Lett. B753 (2016) 660-663, E. Malek, J. Muguran, J. Shock.*

40. *Entanglement negativity in the multiverse, JCAP 1503 (2015) 03, 015. S. Kanno, J. Shock, J. Soda.*

41. *Entanglement entropy of α-vacua in de Sitter space, JHEP 1407 (2014) 072, S. Kanno, J. Murugan, J. Shock, J. Soda.*

42. *Efficient Quantification and Characterization of Bacterial Outer Membrane derived Nano-particles with Flow Cytometric Analysis - International Journal of Molecular Medicine 2014.07.012, Wieser et al.*

43. *Particle-vortex and Maxwell duality in $AdS_4 \times CP^3$/ABJM correspondence, JHEP 1410 (2014) 051, J.Murugan, H. Nastase, N. Rughoonauth, J. Shock.*

44. *Evaluation of Plasmodium falciparum gametocyte detection in different patient material - Malaria Journal 2013, 12:438, Kast et al.*

45. *Magnetic field induced lattice ground states from holography, JHEP 1303:165, 2013, Y.Y. Bu, J. Erdmenger, J. Shock, M. Strydom*

46. *Evaluation of dried blood spots on filter paper for Plasmodium falciparum gametocyte detection with real-time QT-NASBA - Malaria Journal - May 2012, M. Pritsch, A. Wieser, V. Soederstroem, D. Poluda, T. Eshetu, M. Hoelscher, S. Schubert, J. Shock, T. Loescher, N. Berens-Riha*

47. *Holographic Superfluidity from a Magnetic Field - PoS ConfinementX 268 (2012), Y.Y. Bu, J. Erdmenger, J. Shock, M. Strydom*

48. *Chiral phase transitions and quantum critical points of the D3/D7(D5) system with mutually perpendicular E and B fields at finite temperature and density, JHEP 09 (2011) 021, N.Evans, K.Y.Kim, J.P.Shock*

49. *On Stability and Transport of Cold Holographic Matter, JHEP 09 (2011) 030, M.Ammon, J.Erdmenger, S.Lin, S.Muller, A.O'Bannon, J.P.Shock*

50. *Sum rules, plasma frequencies and hall phenomenology in holographic plasmas, JHEP 1102:015, 2011, J.Mas, J.P.Shock, J.Tarrio*

51. *The open string membrane paradigm with external electromagnetic fields, JHEP 1106:017, 2011, K.Y.Kim, J.P.Shock, J.Tarrio*

52. *A note on the velocity of holographic long lived mesons, Phys.Lett.B688:244-247, 2010, J.P.Shock, J. Tarrio*

53. *Holographic hadrons in a confining finite density medium, JHEP 1003:115, 2010, Y.Seo, J.P.Shock, S.J.Sin, D.Zoakos*

54. *Holographic operator mixing and quasinormal modes on the brane, JHEP 1002:021, 2010, M.Kaminski, K.Landsteiner, J.Mas, J.P.Shock, J.Tarrio*

55. *Strings on bubbling geometries, JHEP 1006:055, 2010, H.Lin, A.Morisse, J.P.Shock*

56. *Holographic flavor in N=4 gauge theories in 3d from wrapped branes, JHEP 0902:001, 2009, A.V.Ramallo, J.P.Shock, D.Zoakos*

57. *The AdS/CFT Correspondence and Non-perturbative QCD, AIP Conf.Proc.116:265-284, 2009, J.Edelstein, J.P.Shock, D.Zoakos*

58. *Universal holographic chiral dynamics in an external magnetic field, JHEP 0908:013, 2009, V.Filev, C.V.Johnson, J.P.Shock*

59. *A note on conductivity and charge diffusion in holographic flavour systems, JHEP 0901:025, 2009, J.Mas, J.P.Shock, J.Tarrio*

60. *On the Einstein relation in holographic systems at finite baryon density, The proceedings of the ESP School in High Energy Physics and Astrophysics: The LHC perspective and beyond, Cargese, France, 16-28 June 2008, J.Mas, J.P.Shock, J.Tarrio*

61. *Holographic Spectral functions at finite baryon density, JHEP 0809:009, 2008, J.Mas, J.P.Shock, J.Tarrio, D.Zoakos*

62. *AdS/CFT with flavour in electric and magnetic Kalb-Ramond fields, JHEP 0712:091, 2007, J.Erdmenger, R.Meyer and J.P.Shock*

63. *A Note on chiral symmetry breaking from intersecting branes, Phys.Rev. D76 (2007) 046003, Y.H.Gao, J.P.Shock, W.S.Xu and D.F.Zeng*

64. *AdS/QCD phenomenological models from a back-reacted geometry, JHEP 03 (2007) 064, J.P.Shock, F.Wu, Y-L.Wu and Z-F.Xie*

65. *An Exotic Approach to Hadron Physics, YKIS06 proceedings, 2007, M.Bando, Y.Fukase, J.P.Shock, A.Sugamoto and S.Terunuma*

66. *Holographic confinement/deconfinement phase transitions of AdS/QCD in curved spaces, JHEP 08 (2007) 095, R.G.Cai and J.P.Shock*

67. *Canonical Coordinates and Meson Spectra for Scalar Deformed N=4 SYM from the AdS/CFT Correspondence, JHEP 10 (2006) 043, J.P.Shock*

68. *Embedding Flipped SU(5) into SO(10), JHEP 10 (2006) 035, C-S.Huang, T.Li, C.Liu, J.P.Shock, F.Wu and Y-L.Wu*

69. *Three Flavour QCD from the holographic principle, JHEP 08 (2006) 023, J.P.Shock and F.Wu*

70. *D7 Brane Embeddings and Chiral Symmetry Breaking, JHEP 0503 (2005) 005, N.Evans J.P.Shock and T.Waterson*

71. *Towards a Perfect QCD Gravity Dual, Phys.Lett. B622 (2005) 165-171, N.Evans J.P.Shock and T.Waterson*

72. *Chiral Dynamics from AdS Space, Phys.Rev. D70 (2004) 046002, N.Evans and J.P.Shock*

Workshop Papers

1. *Geometric Representations of African Languages: A Regional Semantic Hub and Cultural Steering, M.A. Said, J.P. Shock, Proceedings of the 6th Workshop on Multilingual Representation Learning (MRL 2026), 230-244, Association for Computational Linguistics, 2026*

2. *Molten Pot: Evaluations & Datasets for Social Offline Reinforcement Learning, J.C. Formanek, M. Hedman, K. Tessera, C.C. Holmes, J.P. Shock, ICML 2026 Workshop on Decision-Making from Offline Datasets to Online Adaptation (poster), 2026*

3. *Graph-Based Exploration for ARC-AGI-3 Interactive Reasoning Tasks, E Rudakov, J Shock, BU Cowley, AAAI 2026 Bridge on Logical and Symbolic Reasoning in Language Models and AAAI 2026 Workshop on AI for Scientific Research, 2026,* `https://arxiv.org/abs/2512.24156`

4. *Entity Multiplexing Through Activation Strength, B Sturgeon, J Shock, NeurIPS 2025 Workshop on Mechanistic Interpretability (accepted), 2025*

5. *Making progress in Trustworthy AI using DeepMind's AI Safety Gridworlds (workshop poster), A Ghoor, J Shock, 4th Muslims in ML Workshop co-located with ICML 2025, 2025*

6. *Coordination Failure in Cooperative Offline MARL, C. Formanek, C. Tilbury, L. Beyers, J.P. Shock, A. Pretorius, ARLET workshop at ICML 2024,* `https://arxiv.org/abs/2407.01343`

7. *Off-the-Grid MARL: Datasets and Baselines for Offline Multi-Agent Reinforcement Learning, AAMAS 2023 extended abstract, J.C. Formanek, A. Jeewa, A. Pretorius, J. Shock*

8. *Reduce, Reuse, Recycle: Selective Reincarnation in Multi-Agent Reinforcement Learning, RRL 2023 poster, J.C. Formanek, C.R. Tilbury, J.P. Shock, K. Tessera, A. Pretorius*

9. *A Sequence Modelling Approach to Question Answering in Text-Based Games, NAACL 2022 workshop, Wordplay, G. Furman, E. Toledo, J. Shock, J. Buys*

10. *Brain Structural Saliency Over The Ages, Machine Learning, Optimization, and Data Science. LOD 2022, D. Taylor, J. Shock, D. Moodley, J. Ipser, M. Treder*

11. *Causal Multi-Agent Reinforcement Learning: Review and Open Problems, S. J. Grimbly, J. Shock, A. Pretorius, Cooperative AI Workshop, NeurIPS 2021*

12. *Automated outcome prediction and assessment with quantitative EEG in severe disorders of consciousness (conference poster abstract, P 132), Clinical Neurophysiology 128 (10) e393, 2017, S. Stefan, B. Schorr, A. Lopez-Rolon, I. Kolassa, J. Shock, A. Bender*

Preprints / Under Review

1. *Two Routes to Interoceptive Prioritisation: Dissociating Likelihood Precision and Preference Reweighting in Active Inference, S.J. Grimbly, N. Kuske, E.A. Boonstra, C. van Hoof, R. Hodson, B. Rosman, R. Smith, M. Solms, J.P. Shock, arXiv:2610.18617, 2026*

2. *Reward Observability and the Limits of Offline Checkpoint Selection in RSSM World Models, N. Smolyanskiy, J. Shock, arXiv:2607.01736, 2026*

3. *Predictable Confabulations: Factual Recall by LLMs Scales with Model Size and Topic Frequency, M.L. Smith, J.P. Shock, S.T. Segun, I.E. Olatunji, T.F. Bissyandé, arXiv:2605.18732, 2026 (under review)*

4. *PyBatchRender: A Python Library for Batched 3D Rendering at Up to One Million FPS, E Rudakov, J Shock, BU Cowley, arXiv:2601.01288, 2026 (under review)*

5. *Sophisticated Learning: A Novel Algorithm for Active Learning during Model-Based Planning, R. Hodson, B. Bassett, C. van Hoof, B. Rosman, M. Solms, J. P. Shock, R. Smith, arXiv:2308.08029, 2025 (under review)*

6. *A Note on Spinning Billiards and Chaos, JS Lund, J Murugan, JP Shock, arXiv:2505.15335, 2025 (under review)*
7. *SSSUMO: Real-Time Semi-Supervised Submovement Decomposition, E Rudakov, J Shock, O Lappi, BU Cowley, arXiv:2507.08028, 2025 (under review)*
8. *Assessing the Case for Africa-Centric AI Safety Evaluations, G. Ireri et al, arXiv:2602.13757, 2026*
9. *Toward an African agenda for AI Safety, S. Segun et al, arXiv:2508.13179, 2025*
10. *Learning Operators with NEAT for Boolean Composition in Reinforcement Learning, A. Esterhuysen, S. James, GN. Tasse, B. Rosman, J. Shock,* `https://doi.org/10.21203/rs.3.rs-5455533/v1`*, 2024*
11. *Chaos and Scrambling in Quantum Small Worlds, arXiv:1901.04561, J. Hartmann, J. Murugan, J. Shock, 2019*
12. *Notes on the Squashed Sphere Lowest Landau Level, arXiv:1909.08042, J. Murugan, J. Shock, R. Slayen, 2019*
13. *Probability Density Functions from the Fisher Information Metric, arXiv:1504.03184, T. Clingman, J. Murugan, J. Shock, 2015*

Seminars

- *What we can learn about ourselves by studying AI. Keynote address at the NeuroAI workshop, Deep Learning Indaba 2026, Pan-Atlantic University, Lagos, Nigeria, August 2026*
- *Building Red-Teaming Capacity for AI Safety Evaluation in African Contexts. Invited panellist, CASA / UCT AI Initiative workshop, Deep Learning Indaba 2026, Lagos, Nigeria, August 2026*
- *uGAP — Unified Geospatial AI Platform: geospatial data for African ML. Research spotlight at the GeoAI for a Climate-Resilient Africa workshop, Deep Learning Indaba 2026, Lagos, Nigeria, August 2026*
- *Meta-Reinforcement Learning. Two-hour invited lecture and tutorial at HAICON26, the Helmholtz AI Conference, Munich, Germany, June 2026*
- *Respondent to Mark Solms' "Making a Mind". SAPI/SAPA Annual Conference, Nelson Mandela Foundation, Johannesburg, May 2026*
- *The Past, Present and Future of AI in Research. Invited talk to the PhD Forum, Department of Paediatrics and Child Health, UCT, Red Cross War Memorial Children's Hospital, May 2026*
- *From Lab to Livelihoods. Invited panellist at the AMLD Africa Conference, Johannesburg, January 2026*
- *What can we learn about ourselves by studying artificial intelligence? Talk given at the University of Helsinki, June 2025*
- *Building an African AI Institute that bridges worlds. Talk given at the INRS, Montreal and the University of Toronto, August and September 2025*

- *Consciousness, illusionism and confabulation. Talk given to Conscium, February 2025*
- *Reinforcement Learning: Meta, Offline, Multi-agent and more. Talk given at the IndabaX, Wits, Johannesburg, South Africa, July 2024*
- *Active Inference, Generative Models and the Embedding Space of Ideas. Keynote address at Mind and Matter 2024, Helsinki, Finland*
- *Rich Embeddings and Deep Understsanding. Keynote address at CEMDI 2024 conference, INRS, Montreal, Canada*
- *From Physics to Machine Learning and back again. NiTheCS Mini-school, 2023*
- *An Introduction to Active Inference. UCT, Department of Computer Science, 2023*
- *2-4 lecture series on the history of AI leading to ChatGPT - Talk given to:*
  - *University of Oxford (October 2023 and Jan 2024)*
  - *UCT summer school (Jan 2024)*
  - *UCT Centre for Innovation in Learning and Teaching (April 2024)*
- *An introduction to machine learning - Talk given to:*
  - *AIMS-Imaginary (November 2020)*
  - *Mathematicians at UCT (September 2019)*
  - *Neuroscientists at UCT (September 2019)*
  - *Psychologists at UCT (August 2019)*
- *Reinforcement Learning - Talk given at:*
  - *University of Helsinki (June 2025)*
  - *NiTheCS (March 2022)*
  - *East African Institute for Fundamental Research (February 2022)*
  - *University of Sao Carlos, Brazil (November 2020)*
  - *UCT, Cape Town (August and September 2019)*
  - *Wits, Johannesburg (June 2019)*
  - *Deep Learning IndabaX - KwaZulu Natal (April 2019)*
  - *INRS, Montreal, Canada (July 2022)*
- *Information Geometry and AdS/CFT - Talk given at:*
  - *KITPC, Beijing (June 2015)*
  - *Wits, Johannesburg (March 2015)*
  - *Max Planck Institute for Physics, Munich, Germany (January 2015)*
- *An introduction to holographic dualities - Talk given at:*
  - *UCT, South Africa, (September 2014)*
  - *Chaos and nonlinear dynamics conference, Maribor, Slovenia, (June 2014)*
- *Entanglement entropy in alpha vacua of de Sitter space - Talk given at:*

  - *KITPC program (July 2014).*
  - *CMTP meeting, UCT, Cape Town (May 2014).*

- *The superconducting QCD vacuum at large magnetic field from holography - Talk given at*
  - *The Institute Henri Poincare, Paris, France (January 2014).*
  - *String theory and black holes conferences, Braga, Portugal (December 2013)*
  - *The Abdus Salam centre for Theoretical Physics, Trieste, Italy (December 2012).*
  - *The KITPC, Beijing, China (October 2012).*
  - *The DESY theory meeting, Hamburg, Germany (October 2012).*

- *A tour of atmospheric optics - Talk given at:*
  - *AIMS Muizenberg, South Africa (Feb 2016)*
  - *The University of Cape Town physics society, South Africa (August 2014).*
  - *Chaos and non-linear dynamics, Maribor, Slovenia (June 2014).*
  - *APC, Paris, France (January 2014).*
  - *The UCT winter program, Cape Town, South Africa (July 2014).*
  - *The University of Northumbria, UK (December 2013).*
  - *The KITPC, Beijing, China (October 2012).*
  - *The Yukawa Institute, Kyoto, Japan (September 2012).*
  - *The university of Cape Town, South Africa (April 2012).*
  - *The university of Santiago de Compostela, Spain (16/12/10)*
  - *The university of Andres Bello, Santiago, Chile (9/8/10).*
  - *Centro Atomico de Balseiro, Bariloche, Argentina (3/8/10).*
  - *The University of Cape Town, South Africa (12/5/10).*

- *An introduction to dualities - Talk given at the department of physics CMTP program at the University of Cape Town, South Africa (September 2013).*

- *An introduction to basic neuroscience - Talk given at the Abdus Salam centre for Theoretical Physics, Trieste, Italy (December 2012).*

- *An introduction to string theory - Talk given at:*
  - *City Varsity, Cape Town (Feburary 2015)*
  - *Truth Coffee Cape Town (February 2015)*
  - *Two highschools in Beijing, China (October 2012).*

- *A passion for science and learning - Talk given at highschools in Beijing, China (October 2012).*

- *The open string membrane paradigm in AdS/CFT - Talk given at:*
  - *The Yukawa Institute, Kyoto, Japan (September 2012).*
  - *The University of Leiden, the Netherlands (June 2012).*
  - *The University of Cape Town, South Africa (April 2012).*

- *The ITP, Beijing, China (September 2011).*
- *The IHEP, Beijing, China (September 2011).*
- *The Institut Henri Poincare, Paris, France (May 2011).*
- *The university of Braga, Portugal (April 2011).*
- *The university of Santiago de Compostela, Spain (April 2011).*
- *The university of Southampton, UK (March 2011).*

- *Generalized linear models for neural systems - a three lecture course given at the University of Cape Town, South Africa (April 2012).*

- *The joys of physics: The history of the universe and fundamental forces - Talk given to four high schools in Beijing, China (September 2011).*

- *Spatially modulated phases in AdS/CFT - Talk given at:*
  - *Southampton University, Southampton, UK (June 2011).*
  - *Talk given at the LMU, Munich, Germany (June 2011).*

- *Strings on bubbling geometries - Talk given at:*
  - *CQUEST, Seoul, South Korea (1/12/10).*
  - *Postec, Pohang, South Korea (29/11/10).*
  - *The ESU, Vienna, Austria (15/9/10).*
  - *The universidad Catolico de Chile, Santiago, Chile (7/8/10).*
  - *CECS, Valdivia, Chile (5/8/10).*
  - *Centro Atomico de Balseiro, Bariloche, Argentina (2/8/10).*
  - *Invited talk at Quantum Gravity in the Southern Cone V, Buenos Aires, Argentina (30/7/10).*
  - *The University of Cape Town, South Africa (10/5/10).*
  - *Santiago de Compostela, Spain (16/3/10).*

- *Spectral functions and Einstein relations from AdS/CFT - Talk given at:*
  - *The fifth Agian string schoolMilos, Greece (4/09/09).*
  - *Gijon, Spain (4/2/09).*
  - *The winter meeting in Madrid, Spain (16/12/08).*
  - *DIAS, Dublin, Ireland (20/11/08).*

- *Photoproduction in Strongly Coupled Plasmas - The Braney solution - Talk given at:*
  - *Porto, Portugal (24/10/08).*
  - *CQUEST, Seoul, Korea (08/08/08).*
  - *The IHEP, Beijing, China (24/07/08).*
  - *The KITPC, Beijing, China (17/07/08).*
  - *The Max Planck Inst. for theoretical physics, Munich, Germany (4/07/08)*

- *AdS/CFT at finite temperature - A series of three talks given at the KITPC, Beijing, China (17/07/08).*

- *AdS/CFT with flavour in electric and magnetic Kalb Ramond elds - Talk given at:*
  - *CQUEST, Seoul, Korea (13/08/08).*
  - *The DIAS, Dublin, Ireland (6/12/07).*
  - *The university of Santiago de Compostela, Spain (13/12/07).*
- *The Confinement/Deconfinement phase transition from a variety of dual supergravity backgrounds - Talk given at the University of Santiago de Compostela, Spain (10/11/07).*
- *Advances in AdS/CFT and AdS/QCD - Talk given at The Quark-Gluon plasma workshop, Wuhan, China (20/06/07).*
- *Linear Confinement in AdS/QCD - Talk given at the ITP in Beijing (20/06/07).*
- *Three paths from AdS to QCD - Talk given at Beida in Beijing (11/05/07).*
- *Heavy quarks in AdS/QCD - Talk given at the ITP in Beijing (15/04/07).*
- *Hadrons from holography - Talk given at:*
  - *Ochanomizu University, Tokyo (5/03/07).*
  - *Tokyo University (30/02/07).*
  - *The Yukawa Institute in Kyoto (24/02/07).*
  - *Tsinghua University in Beijing (23/12/06).*
  - *The ITP in Beijing (17/12/06).*
  - *The IHEP in Beijing (15/12/06).*
  - *The AdS/CFT and strongly coupled quark matter workshop at CCAST in the ITP in Beijing (21/11/06).*
  - *The ITP in Beijing (11/06).*
- *Meson Spectroscopy from the AdS/CFT Correspondence - Talk given at The Quark-Gluon plasma workshop, Wuhan, China (14/8/06).*
- *The AdS/CFT Correspondence and Meson Spectroscopy (SU(3)) - Talk given at Topical Seminar on Frontier of Particle Physics 2006: Beyond the Standard Model, Beijing, China (8/8/06).*
- *Understanding the Strong Force through Gravity - Talk given at Nanchang University, Nanchang, China (06/06).*
- *Flavour Physics from the AdS/CFT correspondence - Talk given at:*
  - *The Yukawa Institute, Kyoto, Japan (03/06).*
  - *Ochanomizu University, Tokyo, Japan (03/06).*
- *An Introduction to the AdS/CFT correspondence - Two talks given in the ITP in Beijing (12/05).*
- *QCD Physics from the AdS/CFT correspondence - Talk given at TASI 2005 (6/05).*
- *The AdS/CFT correspondence with a non-SUSY Deformation and Fundamental Quarks - Talk given at Southampton University (10/1/05).*

- *Brane wrapping in the AdS/CFT correspondence - Talk Given at:*
  - *Southampton University (10/3/05).*
  - *Swansea University(17/3/05).*

Teaching duties

- Honours Computer Science - lectures on reinforcement learning in the artificial intelligence module.
- Machine Learning, from linear regression to deep learning - a one year course given for the National Institute of Theoretical and Computational Sciences, 2022-2025
- Honours string theory - one semester course, 2014-ongoing (classes ranging from 2-15 students)
- Advanced topics in Reinforcement Learning, 2019-ongoing (Honours module)
- An introduction to the mathematics of Machine Learning for Data Scientists, 2023
- MAM1000W - convenor, 2016-2019, (750 students with classes of up to 250 students)
- MAM1000W - first year undergraduate mathematics course, 2013-2022
- MAM1031F/MAM1033F - first year undergraduate mathematics course, 2023- ongoing
- MAM1034H - first year applied mathematics, 2021, 2022.
- 2ND - second year applied mathematics - nonlinear dynamics - 2022-ongoing
- Mathematics and Applied Mathematics Honours course convener 2014.

Committee duties

- Department Exco
- Department deputy head (2023-2024)
- Outreach committee chair
- Workload committee
- Transformation committee
- Planning committee
- Business plan committee
- Faculty level: IT committee chair
- Faculty level: Physical planning committee
- University level: Open textbook award committee
- University level: Senate

Awards

- 2026 JIAS Impact Award — awarded to "Artificial intelligence for HIV care: a global systematic review of current studies and emerging trends" as one of the three most impactful articles published in the Journal of the International AIDS Society, selected by the Editors and Editorial Board
- Distinguished Teacher Award - UCT, 2017
- Commended for the HELTASA teaching award 2019

Grants and external funding

- *Principal Investigator* — African Compute Initiative, IDRC, 2026–2029
- *Co-Principal Investigator* — African Hub on AI Safety, Peace & Security, IDRC / FCDO, 2025–2029
- *Co-lead* — University Capacity Development Grant (UCDG), DHET, 2024–2026: mathematical thinking in first-year mathematics

Policy contributions and international advisory work

- Drafting contributor, U7+→G7 Communiqué on universities and AI governance (January 2025; signed by the UCT Vice-Chancellor and delivered to the G7)
- Invited contributor, World Bank *World Development Report 2026* regional consultation
- Chair, IARU Working Group on AI (11 research-intensive universities, 2025–)

Refereeing and Editing

- Reviewer for: JHEP, Phys Rev B, Neurips, ICML, ICLR, AAMAS, AAAI, SACAIR, ACAIN, General Relativity and Gravitation.
- Guest editor for special edition of Health and Quality of Life Outcomes

Student Supervision

Honours

- Tristan Phillips, Joshua Baillie, Kelvin Wei, Catherine Li, Jing Yeh, Ziya Wessels (2026-)
- Tziyona Cohen, Oscar Duys, Max Elkington, Joseph Goldblatt, Karabo Letsholo, Catalina Althoff-Thomson, Caleb Bessit, Joshua Fouché (2025)
- Nick Bossi, Jack Montgomery, Luke Davis (2024)
- Qiulin Li, Aaron Kovarsky (2023)
- Cher Chen, Lehasa Seoe, Batsi Ziki, Shaun Schoeman, Noah de Nicola (2022)

- Nicky Maluleke, Rahul Mistri, Kabelo Serage, Edan Toledo, Claude Andrews, Anele Siyotula (2021)
- Claude Formanek, Siphelele Danisa, Jeremy Du Plessis, St John Grimbly, Abram Schönfeldt (2020)
- Jibran Bohra, Jeremy Wilkinson, Darien Hillebrand, Logan Geldenhuys (2019)
- Luke Taylor, Jason Connie, Daniel Taylor (2018)
- Lizelle Niit, Dominic Bauer, Lauren Denny (2017)
- Mpho Mafune, Robert Spencer (2016)
- Cara Pienaar, Dean Rance, Sabina Stefan (2015)
- Emma Platts, Tslil Clingman (2014)

Masters

- Primary supervisor for Ben van Dugteren, Tshidiso Mokgele (2026-)
- Co-supervisor for David Andayi, Tumelo Matobo (2026-)
- Co-supervisor for Sian Heesom-Green (2025-)
- Co-supervisor for Antonia Grindrod (2025)
- Co-supervisor for Kristin Haskins (2025-2026)
- Primary supervisor for Kival Mahadew (2025-)
- Co-supervisor for Neville Varney-Horwitz (2026-)
- Co-supervisor for Shiling Deng (2025-2026)
- Primary supervisor for Jean du Plessis (2024)
- Co-supervisor for Binyi Zou (2023)
- Co-supervisor for Jiahao Zhang, Yvetta Lin (2022)
- Primary supervisor for Collins Maripane, Ruan de Kock (2024-)
- Primary supervisor for Tswelopele Moshe (2024-)
- Primary supervisor for Vuyiswa Kubalasa (2024-2026)
- Primary supervisor for Noah de Nicola (2024-2026)
- Primary supervisor for Benjamin Sturgeon (2023-)
- Primary supervisor for Batsi Ziki (2023-2025)
- Primary supervisor for Roland Dubb (2022-2024)
- Primary supervisor for St John Grimbly, Rachel Catzel (2021-2024)
- Primary supervisor for Rivan Rughubar (2021-2023)
- Primary supervisor for Jeremy Du Plessis (2022-2024)

- Primary supervisor for Arinze Folarin (2021-2023)
- Primary supervisor for Siphelele Danisa (2021-2022)
- Primary supervisor for Daniel Taylor, Rowan Hodson (2020-2022)
- Co-supervisor for Zach Wolpe, Abram Schönfeldt (2020-2022)
- Co-supervisor for Mashudu Mokhithi (2020-2021)
- Primary supervisor for Tom Makkink (2020-2021)
- Primary supervisor for Dean Rance (2019-2022)
- Primary supervisor for Alexes Mes (2019-2021)
- Co-supervisor for Jean-Gabriel Hartmann (2018-2020)
- Primary supervisor for Lizelle Niit (2017-2022)
- Co-supervisor for Ruach Slayen (2017-2019)
- Primary supervisor for Vladimir Makic (2017-2020)
- Co-supervisor for Alastair Grant-Stuart (2016-2017)
- Co-supervisor for Tslil Clingman (2015)
- Co-supervisor for Alex Antrobus (2013-2015)
- AIMS Masters primary supervisor for Muhammad Said (2026)
- AIMS Masters primary supervisor for Oluwaseyi Giwa (2025)
- AIMS Masters primary supervisor for Andriniaina Kevinn Adolha Rajaona (2023)
- AIMS Masters primary supervisor for Lupiya Musonda (2021)
- AIMS Masters primary supervisor for Linda Agyapomah Osei-Agyare, Jeasy Roger Bavibidila, Grace Ikhizama (2020)
- AIMS Masters primary supervisor for Yasser Salah Eddine Bouchareb (2018)
- AIMS Masters primary supervisor for Morris Musyoka (2017)
- AIMS Masters co-supervisor for Mohammad Mansour (2015)
- AIMS Masters co-supervisor for Alzaahra Farrag (2014)

Postdoctoral

- Ian Ocholla (2026-)
- Nicolas Kuske (2025-)
- Jeremiah Fadugba (2026-)

PhD

- Primary supervisor for Jack Ngare (2026-)

- Primary supervisor for Wei-Yu Louis Feng (2026-)
- Co-supervisor for Thomas Aldersley (2026-)
- Primary supervisor for Alyssa Amod (2026-)
- Primary supervisor for Tatiana Sango (2025-)
- Primary supervisor for Asad Jeewa (2024-)
- Primary supervisor for St John Grimbly (2024-)
- Co-supervisor for Evgenii Rudakov (2023-)
- Joint-primary supervisor for Mashudu Mokhithi (2022-2025)
- Co-supervisor for Yasser Salah Eddine Bouchareb (2022-)
- Primary supervisor for Claude Formanek (2021-2026)
- Co-supervisor for Rayhaan Perin (2020-2026)
- Joint-primary supervisor for Ruach Slayen (2020-2024)
- Co-supervisor for Emma Platts (2018-2021)
- Primary supervisor for Anthony Sayster (2018-2023)
- Co-supervisor for Justine Tarrant (2014-2017)
- Joint academic advisor for Miguel Strydom (2011-2012)
- Joint academic advisor for Steffan Muller (2011-2012)
- Joint academic advisor for Xie Zhe Feng (2005-2007)

Public outreach

- Chief writer and organiser of Mathemafrica.org blogging platform - up to 20,000 visitors per month.
- Lecture notes on calculus for open source text book publishing.
- Participated in MAM high school mathematics day March 2015.
- Talks given at two highschools within Beijing during October 2012.
- Talks given at several highschools within Beijing during September 2011 on fundamental physics, from cosmology to modern particle physics.
- Talks on atmospheric optics given to the public in Argentina, Germany, Chile, Japan, Spain, UK, France and South Africa
- Popular talks on string theory given to the general public in South Africa

Languages

- Native: English
- Comfortable: Spanish
- Conversant: Mandarin Chinese