NITheCS
National Institute for
Theoretical and Computational Sciences

NITheCS Winter Internship Programme 2025

RESEARCH TOPICS

TOPIC	HOST	HOST INSTITUTION
1. Machine learning models and applications in Computational Mechanics. 2. Data mining and management with application to water and sanitation systems.	Dr Ridhwaan Suliman	CSIR
1. Foundational capabilities of discrete-event models for societal impact. 2. Multiscale model verification, validation and uncertainty quantification (V&V) using statistical algorithms. 3. Theoretical foundations of machine learning models V&V and UQ. 4. Data-driven machine learning models and algorithms. 5. Data mining, management and modelling for decision making. 6. Integrated multiscale modelling and simulation. 7. Machine learning application for material design and characterization. 8. Computational modelling and simulation of material matrix interfaces.	Dr David Tshwane	
1. Compact Stars as Laboratories for Matter at Extremes and Fundamental Physics. 2. Physics and Evolution of the Early Universe. 3. Physics of Core-Collapse Supernovae. 4. Quantum Information Science. 5. Relativistic Fluid Dynamics in Heavy-Ion Collisions and Particle & Nuclear Astrophysics. 6. Relativistic Kinetic Theory in Heavy-Ion Collisions and Particle & Nuclear Astrophysics. 7. Statistical and Thermal Physics in Heavy-Ion Collisions and Particle & Nuclear Astrophysics. 8. Theoretical & Computational Physics & Finance. 9. Theoretical & Computational Physics & the Environment. 10. Theoretical and Computational Biophysics and Medical Physics. 11. Theory and Phenomenology of Relativistic Heavy-Ion Collisions. 12. Trends in Computational, Mathematical and Physical Sciences Education in South Africa 13. Complex Systems Science.	Prof Azwinndini Muronga	Nelson Mandela University
1. Enhancing Bank Profitability through Digital Banking and Artificial Intelligence: A Data-Driven Analysis.	Prof Martin Chanza	North-West University, Mahikeng Campus
1. Open quantum Brownian motion: extensions and applications.	Mr Ayanda Zungu	
1. DNA barcoding of marine invertebrate. 2. Crozet shag genome assembly.	Dr Monica Mwale	South African National Biodiversity Institute

1. Can we measure Fermi constant with astronomical data? 2. Large-scale structure correlations in the Universe. 3. Searching dark matter with radio telescopes.	Prof Yin-Zhe Ma	Stellenbosch University
1. Introduction to open quantum systems. 2. Introduction to quantum computing.	Prof Francesco Petruccione	
1. Game theory for modelling tri-trophic interactions built by introducing weed biocontrol agents. 2. Citizen science monitoring of invasive insects - WaspApp in the making. 3. Sustainable use of Lepidoptera: drone remote sensing and population outbreak mapping. 4. Value of taxonomy and collections: museums, digitized records and citizen science.	Prof Ruan Veldtman	
1. Brownian Motion of a 5D String. 2. Non-holonomic Constraints in Classical and Quantum Mechanics.	Prof Will Horowitz	University of Cape Town
1. Rings and related structures.	Prof Amartya Goswami	University of Johannesburg
1. Mathematical Modelling of HIV/AIDS Dynamics in Developing Countries: Assessing the Impact of Shifts in Donor Funding on Disease Transmission and Control.	Prof Farai Nyabadza	
1. Modification of Einstein's theory of relativity.	Prof Sudan Hansraj	University of KwaZulu-Natal
1. Understanding novel Mxenes as anode materials. 2. Exploring inverse pervoskite for improved solar performance conversion efficiency.	Prof Kingsley Obodo	
1. Application of Machine Learning to Predict Quantum Correlations. 2. Quantum Simulation of Open Quantum Systems using Near-TermIntermediate-Scale Quantum (NISQ) Devices.	Prof Ilya Sinayskiy	
1. Compactifications in Locales. 2. Introduction to Topological Data Analysis.	Dr Cerene Rathilal	
1. Dark side of the QCD.	Prof Deepak Kar	University of the Witwatersrand
1. Application of Data Science in Oncology. 2. Predictive Modelling in Public Health Using Data-Driven Approaches. 3. Assessing the Feasibility of Renewable Energy Deployment in Rural Limpopo (using open -source - IRENA FlexTool). 4. Battery Storage and Grid Flexibility: A Case Study of South Africa's Power Grid. (Using IRENA FlexTool). 5. Modelling the Impacts of Climate Change. 6. Forecasting Energy Consumption. 7. Computational Study and Simulations of Energy Materials for applications in Solar cells (Perovskites, Dye Sensitized) and Energy Storage (Sodium Ion Batteries).	Prof Eric Maluta	University of Venda
1. The current acceleration of the universe. 2. Dark Energy. 3. Modified Gravity.	Prof Aroon Beesham	University of Zululand