



MINI-SCHOOL

NITheCS

National Institute for
Theoretical and Computational Sciences



INTERNATIONAL YEAR OF
Quantum Science
and Technology

Quantum Diagrams: An Introduction to the Graphical Language of ZX Calculus

Dr Kishan Dayaram (Stellenbosch University)

Attend online: Wed 12, 19 & 26 March 2025 @ 14h00-15h00 SAST

ABSTRACT

This mini school explores the intersection of category theory and quantum mechanics as revealed by the ZX calculus – a cutting-edge diagrammatic language for quantum processes. We begin by establishing a theoretical foundation with an introduction to selected core principles of category theory and quantum mechanics, revealing the abstract structures that underpin the ZX calculus.

With this groundwork in place, we introduce the ZX calculus, demonstrating how its visual notation can simplify the complexities of quantum circuits. Practical examples will show how these graphical methods can be applied to quantum circuit design and algorithm optimization.

This course offers a unique opportunity to bridge abstract mathematical concepts with tangible applications in the rapidly evolving field of quantum computing.

BIOGRAPHY

Kishan Dayaram is a postdoctoral researcher in the Quantum@SUN group at Stellenbosch University. He completed his PhD degree in mathematics at the University of Johannesburg in 2024. His current research focuses on categorical quantum mechanics, specifically quantum logic and ZX calculus.



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