

**S E M I N A R**



**Prof Simon Catterall**  
(Syracuse University, USA)

**Date:**

Friday, 5 December 2025

**Time:**

13h15-14h15 SAST

**Venues:**

- P213, Physics Building, East Campus, WITS
- Online

**Who should attend?**

All are welcome!

**Enquiries:**

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# Lattice Quantum Field Theory: Successes and Future Challenges

**ABSTRACT:**

Our understanding of the elementary building blocks of matter and their interactions is encapsulated in the Standard Model of Particle Physics. This is a quantum field theory, and the particles observed at experiments such as the Large Hadron Collider at CERN are the elementary excitations of those quantum fields. Certain aspects of the Standard Model can be computed with incredible accuracy using perturbation theory. However, the strong interactions of quarks cannot be treated this way and require numerical simulation – this is the field of lattice QCD.

I will give an elementary introduction to this theory and highlight some of its main successes. I will then show how these lattice techniques can be extended to explore the remaining pressing problems in our understanding of the Universe – what is the physics that keeps the Higgs boson light, what are the quantum properties of black holes, what is dark matter, and how can we quantize gravity? These are hard problems, but I will argue that thinking in terms of quantum field theories in discrete spacetime offers new conceptual and computational tools that can be used to address these questions.

*Simon Catterall is an American physicist and professor at Syracuse University, USA. His research focuses on high-energy theory, with a particular emphasis on lattice field theory. He was elected a Fellow of the American Physical Society in 2016 in recognition of his numerous important contributions to computational physics and lattice field theory through studies of gravity, technicolor, and especially the lattice formulation of supersymmetric field theories.*

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