



## **INSIGHT SEMINAR: Quantum structured light takes shape**

**ANDREW FORBES**

April 23, 2025

12:00 to 13:00

Elements Room

---

### **ABSTRACT:**

Quantum structured light offers a roadmap to high-dimensional and multi-dimensional quantum states by exploiting all of light's many degrees of freedom at the quantum level. In this talk, I will review the recent progress in quantum entanglement of photons in their spatial degree of freedom: quantum structured light. I will explain how to create high-dimensional quantum states in the laboratory, how to measure them, and review the present state of the art in the field. I will show how the patterns can be abstracted, mixing degrees of freedom to produce quantum topologies in light, introducing new paradigms for quantum state observables and classification. Finally, I will outline the advantages and disadvantages of using such single photon and entangled states in real-world applications, offering a perspective on the present challenges and exciting opportunities in the field.

**BIO:**

Andrew has at various times in his career found himself as teacher, janitor, secretary, receptionist, web-master, systems engineer, sales rep, manager, director, and sometimes a scientist. Andrew is presently a Distinguished Professor within the School of Physics at the University of Witwatersrand (South Africa) where he leads a laboratory for Structured Light. Andrew is active in promoting photonics in Africa, a founding member of the Photonics Initiative of South Africa and Director of South Africa's Quantum Technology Initiative. He is a Fellow of SPIE, Optica, the South African Institute of Physics (SAIP), and an elected member of the Academy of Science of South Africa. He holds an A-rating by the South African NRF, 4 honorary professorships, is editor-in-chief of the IOP's Journal of Optics and sits on the editorial board of five other international journals. Andrew has won several awards, including the NRF national award for his contributions to photonics in South Africa (2015), the Georg Forster prize from the Alexander von Humboldt Foundation for outstanding contributions to photonics (2020), the SAIP Gold Medal (2020), the highest award for physics in South Africa, making him the youngest winner to date, the Sang Soo Lee award (2022) from Optica and the Korean Optical Society and the TWAS Prize for Physics (2024). Andrew spends his time having fun with the taxpayers' money, exploring structured light in lasers as well as classical and quantum optics.

**Hosted by:** Prof. Dr. Juan P. Torres