

1,2,3 infinity: quantum mechanics with pictures

To be presented by:

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Photons can be described in terms of their spatial modes – the “patterns” of light. As there are an infinite number of spatial modes, entanglement in this degree of freedom offers the opportunity to realise high-dimensional quantum states. In this talk I will review the recent progress in quantum entanglement of photons in their spatial degree of freedom. I will explain how to create high-dimensional quantum states in the laboratory, how to measure them, and what the present state of the art is in terms of applications. In particular, I will outline the advantages and disadvantages of using such entangled states as a means to encode information for secure quantum communication channels, and will consider the preservation of entanglement through noisy channels, e.g., a turbulent atmosphere. Finally I will outline some ideas on mimicking quantum entanglement behaviour with classical light.

Speaker Bio: Andrew received his PhD (1998) from the University of Natal (South Africa), and subsequently spent several years working as an applied laser physicist, first for the South African Atomic Energy Corporation and then later in a private laser company where he was Technical Director. In 2004 he joined the CSIR National Laser Centre where he was Chief Researcher and Research Group Leader of Mathematical Optics. In March 2015 Andrew joined the U. Witwatersrand on the Distinguished Professor programme and has established a new laboratory for Structured Light. Andrew chairs many international conferences and serves on the editorial board of three optics journals. He has published more than 300 scientific papers and his work has won more than 50 awards over the years. He is active in promoting photonics in South Africa, a founding member of the Photonics Initiative of South Africa, a Fellow of SPIE and a member of the Academy of Science of South Africa. In 2015 Andrew won the NSTF award for his contribution to photonics. Andrew spends his time having fun with the taxpayers’ money, continuing his love affair with laser and optics.