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NITheCS COLLOQUIUM:
Photons in quantum communication and computation

Pablo Veganzones Parellada (University of Valladolid, Spain)

Monday, 18 March 2024 | 16h00 – 17h00 SAST

Venue: **Neelsie Cinema, Stellenbosch University, and online**
--- Cheese and wine will be served at the venue ---

ABSTRACT

Since the discovery of electromagnetic radiation by Maxwell and Hertz in the 19th century, light has been our preferred information carrier. Little it was known to them that the quantum revolution of the 20th century would, once again, reshape our understanding of light and unlock new ways of communicating and calculating. Photons and the newly discovered laws of quantum mechanics (uncertainty, wave-function collapse, Bell inequalities…) enabled new cryptographic protocols and computation algorithms.

In this colloquium, we review some of the applications of photons in secure quantum communications and information processing. In communication, they allow for fast transmission of information and, if attenuated to the few photons level, we can use quantum mechanics to establish new cryptographic protocols or transmit quantum information. In computation, however, light is trickier than other systems since photons do not interact between them (in first order). A deeper theoretical understanding of optical circuits is required to accompany the recent experimental advances if quantum optics is to be regarded as a viable computational technology.

BIOGRAPHY

Pablo is a theoretical physicist and mathematician pursuing a PhD on quantum physics at the University of Valladolid, Spain. He is doing theoretical research in linear quantum optics using group theory and searching for useful applications of linear optics in quantum computation, information and simulation. His work is under the umbrella of a National and European project to establish a secure quantum communications network in Spain and Europe. Aside from his main research, he is interested in related fields like quantum machine learning, quantum field theory or symplectic geometry. He enjoys programming and has developed several packages such as QOptCraft – a Python package for linear optics.

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