SA QuTI South African Quantum Technology Initiative

NITheCS National Institute for Theoretical and Computational Sciences

International Year of Quantum Science and Technology

SEMINAR

Demystifying graviton detection

Prof Igor Pikovski

(Stevens Institute of Technology, USA, & Stockholm University, Sweden)

Thursday, 7 August 2025 @ 14h00-15h00 SAST

Venues: Online and Physics Seminar Room, Stellenbosch University

ABSTRACT

Quantum gravity has long been thought to be confined to pure theory, with little hope of experimental input. But this is rapidly changing. In this talk, I will give a brief overview of new ideas on how quantum technologies enable table-top tests that can probe aspects of quantum gravity, and of quantum dynamics on curved space-time. I will then focus on the detection of single gravitons as one example, showing that the absorption and emission of individual gravitons can be detected with new quantum systems. The result relies on quantum sensing of discrete energy transfer of only single quanta between a gravitational wave and a detector. I will present how and why graviton detection is realistic, and why it has been overlooked previously. I will also discuss its relevance for first tests of properties of single gravitons with a historic inspiration from early tests of the quantum properties of light. Even though graviton detection alone is insufficient to conclusively prove that gravity must be quantized, the results show that it can provide empirical input on linearized quantum gravity and its alternatives, in analogy to the exploration of the quantum nature of light in the early 20th century.

BIOGRAPHY

Igor Pikovski is a theoretical quantum physicist, working as the Geoffrey S. Inman Jr. Professor of Physics at Stevens Institute of Technology, USA, and at Stockholm University, Sweden. His research is in quantum information science and quantum optics theory, with a focus on studying how gravity and quantum physics can meet in experiments. Igor obtained his PhD in 2014 from the University of Vienna and then worked at Harvard University as an ITAMP Postdoctoral Fellow and Branco Weiss Fellow until 2018. His main research interest is the intersection between AMO physics and fundamental science, such as studying how to test quantum mechanics at macroscopic scales, how curved space-time affects quantum systems and how new quantum technologies can be used for tests of quantum gravity.

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