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‘Observing a changing Hilbert-space inner product’

Prof Barry Sanders (University of Calgary, Canada)

Thursday, 14 April 2022, 12h00 SAST

ABSTRACT

In quantum mechanics, physical states are represented by rays in Hilbert space H, which is a vector space imbued by an inner product ⟨|⟩, whose physical meaning arises as the overlap ⟨ϕ|ψ⟩ for |ψ⟩ a pure state (description of preparation) and ⟨ϕ| a projective measurement. However, current quantum theory does not formally address the consequences of a changing inner product during the interval between preparation and measurement. We establish a theoretical framework for such a changing inner product, which we show is consistent with standard quantum mechanics. Furthermore, we show that this change is described by a quantum operation, which is tomographically observable, and we elucidate how our result is strongly related to the exploding topic of PT-symmetric quantum mechanics. We explain how to realise experimentally a changing inner product for a qubit in terms of a qutrit protocol with a unitary channel.

BIOGRAPHY

Dr Barry Sanders is Director of the Institute for Quantum Science and Technology at the University of Calgary, Lead Investigator of the Alberta Major Innovation Fund Project on Quantum Technologies, a Distinguished Chair Professor at the University of Science and Technology China and a Vajra Visiting Faculty member of the Raman Research Institute in India.

He received his BSc degree from the University of Calgary in 1984 and a Diploma of Imperial College, supervised by Prof Sir Thomas W. B. Kibble, in 1985. He completed a PhD in 1987 at Imperial College, London, supervised by Prof Sir Peter Knight.

His postdoctoral research was done at the Australian National University, the University of Queensland and the University of Waikato. Dr Sanders was on the Macquarie University faculty from 1991 until moving to Calgary in 2003.

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